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The 1980 Dudley C. Sharp Award for Outstanding Achievement in Logistics

The Honorable Hans Mark
The Secretary of the Air Force

(The following remarks were made by Dr. Mark during the award ceremony on 10 September 1980 in the Pentagon)

Ladies and Gentlemen, I am very pleased to be here to preside over the first award of a new recognition that has been established.

I am continually amazed by the great variety of people we have in the Air Force who are blessed with originality and intelligence and inventiveness to do new things. We now have two awards that are named after former Secretaries, one is the Harold Brown Award which deals with the question of how we invent new things. You may remember that a month ago we had a ceremony in this room for the Harold Brown Award for 1980 where we talked about a remarkable new theory that allows us to predict how the upper atmosphere behaves. This theory is terribly important for the Air Force in terms of the communications systems we have and the other things that we need to do.

Today we have an equally remarkable award which has to do with how we keep our equipment going. It makes no sense at all to build new equipment and to generate new weapons, if we don't also learn how to keep the things we've got going and useful. It is for this reason that we are here today to honor Chief Master Sergeant Samuel C. Monroe.

I'd like, in a few words, to try to explain to you what he's done, because it is remarkable. The units that Chief Monroe has created are the Combat Logistics Support Groups. What I'd like to talk about is the idea, because the idea starts with an attitude and with a philosophy, and that, of course, is what's important with any new idea. The best analogy I've been able to think of in reading as a way of describing his achievement is that, what the Chief has done, is to establish a logistics maintenance service for airplanes that makes house calls, rather than have the airplanes come to the doctor's office. The importance of this concept is that, very often, the house call is both quicker and more effective than going to the clinic. When the doctor comes to you, you have a chance on your own home ground to explain to him what's wrong. You can work together much more closely than you would in the much more impersonal atmosphere of a distant depot. I really think that the importance of Chief Monroe's contribution is the recognition of the attitude and the philosophy involved in doing things that way rather than waiting until the airplane is really sick and bringing it back to the hospital.

Innovations of that kind are so important, and its for that reason that we're gathered here to recognize Chief Monroe. The award today is named after the former Secretary of the Air Force who served first as an Assistant Secretary for what was then called materiel. But, I guess words changed, and he did have in his bailiwick the kind of work that goes on at our logistics centers. Just as we chose to name the Harold Brown Award after someone who had distinguished himself in the development area, we have now chosen to name this award after someone who has distinguished himself in the area of maintenance and logistics in order to make certain that these two fields, which are both important, enjoy the same prestige in the Air Force system. It's a very great pleasure for me, then, to have the opportunity to introduce Chief Monroe to those of you who haven't met him and what I'd like to do now is to have the actual citation read.

"Citation to Accompany the Presentation of the Dudley C. Sharp Award for 1980 to Chief Master Sergeant Samuel C. Monroe. Chief Master Sergeant Samuel C. Monroe distinguished himself by outstanding performance while assigned to the Directorate of Resource Management, Headquarters, Air Force Logistics Command. Sergeant Monroe developed techniques to return badly needed battle damaged aircraft to their units in war and to give the Air Force more capability in peace. Through introduction of these methods, and by other innovations, he gave Combat Logistics Support Squadrons new life and meaning, and increased overall readiness of Air Force operational units worldwide. Sergeant Monroe's accomplishments reflect the highest credit on himself, the logistics community and the United States Air Force."

This award consists of a medallion for Sergeant Monroe, there is also a permanent plaque which will be hung in the hall across from where the Harold Brown plaque is hung. This will be hung here with your name on it as the first recipient of this very important award.

(Nominations for the 1981 Dudley C. Sharp Award should be submitted through channels in time to reach HQ USAF/LE by 15 March 1981. Details are contained in AFR 900-33.)

Life Cycle Cost and Effectiveness Analysis on Major Weapon System Alternatives

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Abstract

In this article Life Cycle Cost and Effectiveness Analysis (LCCEA) is addressed from the standpoints of why it must be done, how can it best be done (in general terms), and when should it be done to have the greatest acquisition impact. Four major AF Weapon System Programs in which AFALD has direct experience and for which LCCEA played a significant role are discussed. Lessons learned from those experiences and a future direction of needed LCCEA effort is identified.

Introduction and Purpose

Life Cycle Costing embodies a number of analytical and judgmental techniques which are aimed at assessing the near and long term cost impacts of acquisition/modification programs. Costs of interest include research, development, production/modification, operation, support and disposal. A veritable myriad of techniques exist for addressing each of these cost categories and the components therein. It is not the purpose of this paper to discuss these techniques at any length but suffice it to say, they exist and are being accomplished as part of the logistics engineering process on almost all major and most less-than-major acquisition/modification programs within the Air Force.

One significant point to be stressed relative to life cycle costing is that it is being done for two somewhat distinct and independent purposes. One purpose, and that which is most relevant to the perspective of this paper, is embodied in the following quote:

> "To introduce the consideration of current and future cost consequences along with performance and schedule aspects in making today's decisions on the acquisition of new systems or equipment." [1]

The key point here is the need to make rational decisions on alternative system concepts based on *relative* cost differences in context with schedule and performance aspects.

The second purpose of life cycle costing deals directly with the need for *complete* and reasonably *accurate* forecasting of the total, time phased LCC impacts of a new system to support program management programming, budgeting and evaluation requirements. This purpose for LCC normally becomes important after commitment to a specific hardware acquisition program. Obviously, a logical and traceable translation between these two purposes' for life cycle costing is needed and a major DOD initiative to this end is well underway within the Air Force [2].

System effectiveness analysis is the other important element of LCCEA and it involves the aggregate effectiveness modeling of a system based on its performance characteristics. It falls within the systems engineering process and involves the iterative trade-off of different performance parameters across various subsystems in an attempt to achieve necessary system effectiveness levels in light of the established threat baseline.

In recent times, the Design-to-Cost (and more recently, Design-to-Life Cycle Cost) philosophy has been developed and applied in attempt to force program managers to make performance-cost-schedule trade-offs in context with each other. This logically leads to LCCEA at the system level where it is important to note that "system" also encompasses the logistics subsystem which must (hopefully by design) come into being. However,the D-T-C (or D-T-LCC, if you like) philosophy is normally implemented after the Air Force has committed to a specific hardware acquisition program. For the purposes of this paper, our interest lies in the application of LCCEA as a basis for making such a hardware development or production commitment or at least in comparative analysis of major weapon system hardware alternatives of a given type (e.g. bomber, cargo, fighter, ICBM, etc.).

Specific discussions follow relative to how the Air Force Acquisition Logistics Division (AFALD) has provided direct LCCEA support to the following three programs:

a. Advanced Tanker Cargo Aircraft (ATCA)
b. Cruise Missile Carrier Aircraft (CMCA)
c. Air Launched Cruise Missile (ALCM)

In addition, an independent study conducted by AFALD on aerial tanker aircraft is also discussed since it further illustrates how LCCEA can support decision making between and among alternative hardware solutions to a mission need.

Finally, lessons learned from these four major studies and a future recommended direction for LCCEA effort are discussed.

Advanced Tanker Cargo Aircraft

The Advanced Tanker Cargo Aircraft program (now referred to as the KC-10A with the Air Force) involved selection of a commercial, wide-bodied aircraft from either Boeing (B-747) or McDonnell Douglas (DC-10) to be modified by the prime contractor into a tanker/cargo configuration. The DC-10 was selected and a significant LCC savings will be realized because of the savings resulting from the government not having to finance already sunk RDT&E efforts and through purchase discounts offered by the manufacturer because of the increased DC-10 production run. In addition, a savings should be realized because the AF has purchased Contractor Logistics Support (CLS) from the prime while this CLS contract was competed with an airline, a freight carrier, and a modification contractor. In addition, CLS savings will be achieved because the AF is maximizing standardization between the KC-10A and DC-10's which are commercially operating. This allows the KC-10A to directly share in economy of scale benefits with the already existent commercial airline maintenance posture (e.g., spares pools, use of existent maintenance facilities).

LCCEA plays a major role in both the aircraft source selection and in selection of the CLS contractor. Both aircraft manufacturers provided LCC estimates for varying quantities of ATCAs which were then updated as part of the Best and Final Offers. The Air Force then analyzed these LCC projections for reasonableness using existing system experience factors and comparable commercial experience. What made LCC credible

is the fact that the contractor signed up for much of the potential O&S costs through fixed price or fixed price redeterminable agreements. Specifically, each aircraft manufacturer bid his acquisition prices and, for five years, all of the operating and support costs excluding base personnel (operations and maintenance) and fuel (plus a small, additional amount of base consumables). Since commercial airlines were also bidding on the CLS contract, they provided further competition and credibility, particularly in making relative comparisons between the two aircraft.

If we were to take a contractually pre-estabished ATCA procurement schedule of twenty DC-10's for example, 57% of the twenty year LCC is accounted for in contractual prices (subject to an escalation price adjustment clause). This includes unit procurement prices and CLS pricing up through five years of operation. An additional fifteen years of extrapolated CLS costs and twenty years of fuel cost price-out at 28% of the LCC. The remaining 15% of LCC represents in-house AF costs which can be reasonably estimated based on commercial experience and similar AF system experience. This approach leads to a reasonable degree of confidence in the resulting LCC projections.

Another important element of the LCCEA evaluation included the use of mission scenarios for relative cost and capability comparisons. Specifically, the numbers of DC-10s versus B-747s were computed using mission analysis models for six specified wartime scenarios. Life cycle costs were then estimated for each ATCA type for each of the six mission scenarios. Thus, we were able to hold capability constant and make relative LCC comparisons. Conversely, LCC was held constant while allowing capability to vary. Mixed fleet costing (in the event quantities of both B-747 and DC-10 ATCA types were purchased) was also accomplished in order to show what one sacrifices in either cost or capability if the mixed fleet purchase option was pursued. Operating and support comparisons with existing aircraft (e.g., KC-135) could also be made in this manner.

A considerable number of sensitivity analyses were also made as part of the LCCEA effort. Specifically, changes were made and analyzed relative to procurement funding, fuel escalation, maintenance manning, aircrew ratios, escalation in general, acquisition schedules, and so on. These sensitivities provided additional insight for the source selection decision process.

Cruise Missile Carrier Aircraft

In the case of the Cruise Missile Carrier Aircraft, the Strategic Systems Program Office (ASD/YY) was faced with the requirement to specify the most cost effective CMCA option to pursue in a subsequent, major developmental program. The options considered included wide-bodied commercial derivatives, narrow-bodied commercial derivatives, a B-1 variant, and the two competitive prototypes for the Advanced Medium STOL Transport (AMST). An independent, "short-fused" LCCEA was conducted by a small group (three individuals) of operations research/cost analysts to highlight the key cost and effectiveness sensitivities across the various options. This group worked as part of and dialogued with the larger study group. One result of this effort was the development of an analytical model oriented to an LCC assessment of the CMCA job at hand; namely the successful launching of a fixed number of cruise missiles assuming a surprise, first strike assault of the CMCA bases in context of the total strategic forces beddown (e.g., bombers, intercontinental ballistic missiles).

A relatively simple analytical model was developed and implemented on a desk-top, programmable calcualtor. It was subsequently refined in an iterative manner based on the evolving knowledge gained from sensitivity analyses. The sensitivities analyzed included:

a. Nuclear hardness
b. Basing (squadron sizing and geographic location)
c. Lethal Defenses
d. Non-lethal defenses
e. Escape velocity
f. System Reliability and Maintainability Characteristics

Those characteristics which were found to be the most LCC sensitive were analyzed in considerable detail using multiple analysis techniques and one or more individuals or teams. For example, base escape success as a function of escape speed and basing concept was analyzed using a relatively simple analytical geometry approach and a sophisticated computer simulation. Comparability of results helped to enhance confidence in them. Non-comparability lead to further analysis and required explanation of the differences.

Because of the inherent responsiveness of the programmable calculator, numerous runs and model refinements could be made in near realtime. For a given level of effectiveness, changes in the threat baseline (which is notoriously uncertain or subject to future change due to the reactive policies of the enemy) were quickly analyzed across all the CMCA options. This allowed for the derivation of the optimal CMCA "specification" with LCC impacts clearly highlighted for changes to the threat baseline. Senior Air Force and DoD management can now select which CMCA option to pursue with an appropriate recognition of each options sensitivity to changing threat levels. Although the LCC impacts are not completely accurate in an absolute sense, they do provide insight into the relative cost implications of various CMCA performance characteristics and operating and support policies in context with the threat baseline and changes thereto. The risk of making a bad decision is, thus, greatly reduced.

Air Launch Cruise Missile

The Air Launched Cruise Missile is another program for which LCCEA is playing a major role. In particular, a rather simple and straight-forward analysis was done to show the impacts of operational availability on system LCC for a given level of effectiveness. It was assumed that the job to be done was to have a fixed number of successful ALCM target strikes and life cycle cost was then computed as a function of day-to-day operational availability. The results of this analysis are shown in Table 1.

Table 1. ALCM System LCC Results
(Based on 10 Year Life Cycle, Constant FY78 $)

*ALCM Mission Availability**	*LCC as Percentage of Baseline*
1.0	100%
.9	111%
.8	125%
.7	143%
.6	167%
.5	200%

** ALCM mission availability is, for our purposes, defined as the probability, at any random point in time, that an ALCM can be successfully launched, complete all phases of the mission, and hit the specified target within prescribed accuracy requirements.*

As can be clearly seen, LCC is *highly* sensitive to changes in operational availability and this emphatically pointed out the need for the program office to focus management attention on this critical performance parameter. Contractual techniques

oriented to availability requirements have been pursued by the program office while the ALCM was still in the competitive development and demonstration phase. In addition, LCC and operational availability were considered during the source selection for production.

One point that needs further emphasis is the fact that the LCC values shown in Table 1 are estimates for the entire ALCM delivery system. These costs include the acquisition and O&S costs associated with the ALCM and also ten years worth of O&S costs for the B-52G carrier fleet and associated tanker (KC-135A) support (Note: Costs associated with modifying the B-52G for carriage and launch of ALCMs are not included). In point of fact, the ALCM associated costs represent only 22% of the total shown at any given availability level.

Aerial Tanker Study

We have already discussed the role that LCCEA played in the Advanced Tanker Cargo Aircraft source selection. The discussion here will now discuss how LCCEA is being used to determine to what extent various tanker (including the ATCA) and non-tanker alternatives should be pursued in light of future DoD aerial refueling requirements.

The initial objective of the analysis was to determine the mix of KC-135A (existing tanker), KC-135RE (reengined KC-135A) and KC-10A (ATCA) aircraft which would produce the maximum effectiveness (in terms of pounds of fuel offload) subject to various constants. In addition, new narrow bodied tanker options were subsequently added to the analysis. This problem was well suited to a linear programming approach and was formulated as such. Besides the inherent fuel offload capability of each tanker, the objective function also considered the capability of each tanker, to surge its wartime flying hours in a relative sense over that of the KC-135A.

Four constraints act on this maximization problem. The first constraint requires that the solution not have a total number of KC-135As and KC-135REs greater than the number of airframes on-hand presently, 585. The second and third constraints involve costs of the alternative systems. In analyses of this type it is very important to make the distinction between two types of costs. The second constraint places a limit on the number of dollars available for Operations and Support (O&S) costs over the lifetime of the fleet. The third constraint establishes limits on the total number of dollars available for acquisition and modification (A/M) of the tanker systems. Thus, in this analysis we directly separated O&S cost considerations from A/M cost considerations to be able to compare and assess the impact of each category. The final constraint relates to the availability of refueling booms. Specifically, the constraint requires, after accounting for differences in aircraft wartime surge flying hour levels, that the number of refueling boom equivalents will not be less than 585 (i.e., what the Air Force presently has with the KC-135A fleet).

The results of the analysis showed where to best commit Air Force dollars. Of even more interest, however, was the series of sensitivity runs which could easily be made using the computer linear programming routine. Impacts on the optimal fleet mix were highlighted for changed in acquisition/modification budget, relaxing of the outyear operating and support cost constraint and increases in tanker boom minimum requirements.

It is recognized that cost and performance data for some of the tanker options were "soft" (i.e., uncertain). Additional sensitivity analyses are highlighted, in a generic fashion, in Figures 1 and 2.

Figure 1 shows the maximum the Air Force can afford to spend on the KC-135RE option as a function of its wartime surge ratio (over the KC-135A baseline) and changes to

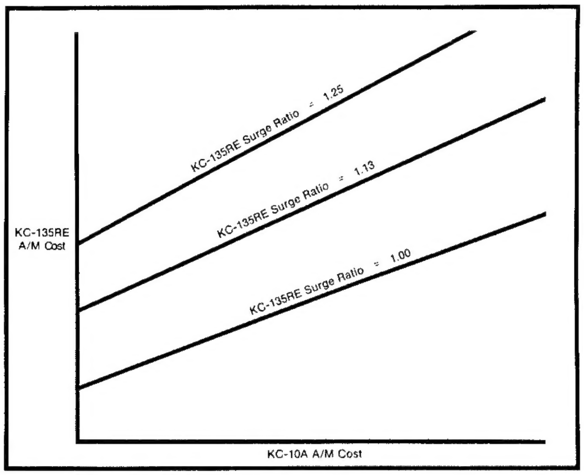

Figure 1. Maximum Affordable Expenditure on KC-135RE as a Function of KC-10A Acquisition/Modification Costs

KC-10A acquisition/modification costs. Figure 2 again shows the maximum the Air Force can afford to spend on the KC-135RE but in this case it is as a function of changes to its own surge ratio and that of the KC-10A. These sensitivity analyses are particulrly useful in highlighting the impacts of data uncertainties on the results of the analysis. They are extremely powerful as decision aids in the force allocation mix determination process.

Besides looking at tanker aircraft alternatives, this study also addressed the relative cost effectiveness of other alternatives to satisfying a tanker shortfall. Other options considered included B-52 reengining (which would reduce tanker requirements), changes to fighter deployment tactics,

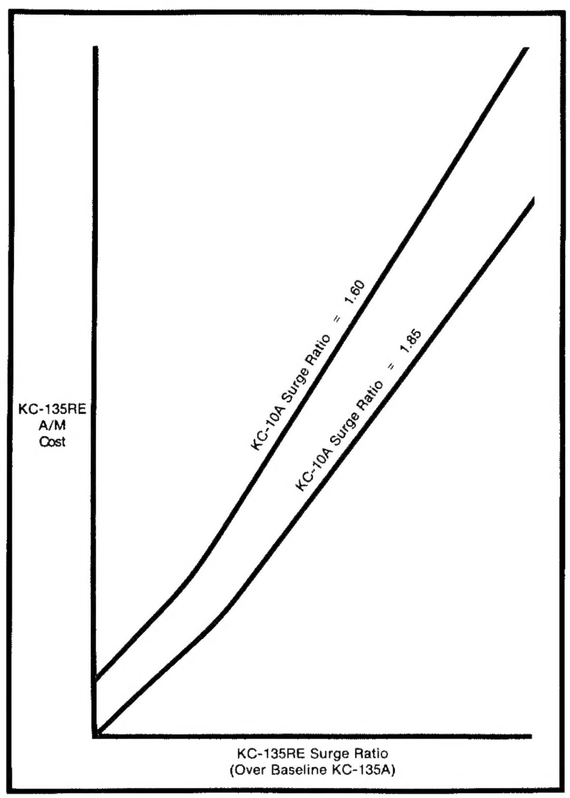

Figure 2. Maximum Affordable Expenditure on KC 135RE as a Function of Its Own Surge Ratio

use of additional fuel tanks on fighters (conformal tanks), multi-point refueling systems, and so on. In conducting an LCCEA, it is important to not unduly restrict the potential solution opportunity set (e.g., to look at only new tanker options when there are means of satisfying tanker shortfall requirements).

Lessons Learned

In each of the above discussed weapon system alternative selection efforts, LCCEA was needed and, in fact, has played or is playing an important role in the decision process. The key lessons to be learned from these successful applications of LCCEA will now be summarized.

Ideally LCCEA should be done before making a major developmental commitment to a particular hardware option. Decisions concerning acquisition of a major weapon system have a significant impact on the size of the DoD budget. In the Air Force, for example, approximately 45% of the projected FY80 Total Obligational Authority is categorized as investment (RDT&E, Procurement, and Military Construction) [3]. The remaining 55% is categorized as operations and maintenance which mainly consists of personnel, fuel, and material costs. Further significant reductions in AF personnel and aircraft flying hours (which drive fuel, personnel and material costs) appear somewhat unlikely. Thus we conclude that it is the investment portion of the budget which is subject to a greater degree of influence and it is here where LCCEA can play a significant role. In addition, weapon system acquisition decisions also influence operations and support costs as well since such decisions determine fleet sizes and system O&S characteristics and both of these factors drive outyear O&S costs.

Assuming an LCCEA is done early-on, the results need to be heeded. If a program commitment is to be made based strictly on factors other than cost effectiveness (e.g., political), then LCCEA becomes but a "filling-the-square" exercise and the temptation is to bias results to support the already preferred hardware solution. It is recognized that LCCEA is not the only decision criterion of interest but it normally should be a significant one. This is particularly true in the current, tightly constrained DoD budget situation. The Air Force is no longer buying thousands of aircraft each year [3]; therefore, of the hundreds that we do buy we had better make sure they are the right ones.

In doing an LCCEA, it is important to look at the entire system—here system includes all elements necessary to do the wartime job. In the case of the ALCM, the carrier, tanker support, and the entire operating and support structure necessary for the system to function. The age-old problem of suboptimizing at the expense of overall system effectiveness must be avoided.

A fundamental axiom of LCCEA when looking at weapon system alternatives is to do the costing to a fixed level of effectiveness differences. In either case, the key is to size the fleet based on wartime effectiveness measures and to cost-out the fleet based on peacetime life cycle operation. The distinction between front-end cost (development and procurement) and outyear costs (O&S) must be recognized as was done in the tanker study. The most cost effective approach may be unrealizable if one cannot get the necessary front-end money to undertake the program.

We recommend that LCCEA be initially approached through the use of an analytical formulation. A relatively simple, straight-forward analytical model can be used to focus subsequent efforts on those performance, operating, and support parameters and policies which "drive" LCC and/or effectiveness (the CMCA analysis is an excellent case in point). More sophisticated analyses, which can include large scale simulations, can then be used on the more critical (sensitive) parameters to help reduce uncertainty about them and their effects. Do not over-react to the apparent "roughness" of portions of the analysis. In all the analyses cited above, the resulting analysis provided valuable insight particularly from the cost and effectiveness sensitivity standpoint. The need for ingenuity in highlighting these sensitivities and subsequent refinement of the analysis cannot be overstressed. In addition, a straight-forward approach is one which can be understood and appreciated by non-analytical decision authorities.

The results of an LCCEA should not be set aside once a commitment to a hardware development program is made. Ideally it should be updated periodically, and as a result of significant events internal and external to the program. Examples of significant internal program events include cost growth, the uncovering of performance or supportability deficiencies, and so on. Examples of significant external program events which would merit LCCEA update are the advent of potentially lower cost weapon system alternatives, threat baseline changes,and so on. Perhaps it was some combination of these internal and external events which lead to the B-1 decision and increased emphasis on cruise missile development. In any event, what is needed is to make these type of decisions with an objective understanding of the cost and effectiveness implications. Program managers should not be inherently motivated, as they seem to be today, to press on to production regardless of the cost and effectiveness potential of their system.

One Final Recommendation

Within the Air Force, mission area analysis continues to evolve to satisfy the implementation of the concepts, policies and procedures articulated in OMB Circular A-109 and set forth in DoD Directives 5000.1 and 5000.2. AFR 57-1, Statement of Operational Need, states the Air Force policy in this regard and it is within this structure that LCCEA needs to play an important role. Although not specifically called for in AFR 57-1, it is our opinion that LCCEA should become an official part of the "need solution stage" which leads up to the conceptual phase review.

The authors do not foresee any insurmountable problems with the development, refinement, and application of LCCEA techniques during this early stage of the acquisition life cycle. Where we do feel a problem exists is in the degree to which cost and systems effectiveness analysis capability and responsibilities are fragmented throughout the Air Force. Examples of Air Force organizations which could or should, on any given program, be involved include USAF/SA/XO/AC, Using Commands (AC, XO, XR), AFSC/AC, AFSC Product Divisions (AC, XR, YX, YC, EN), AFLC/AC/XR, AFALD/XR/YT, ATC/AC and so on (Note: this list is not considered exhaustive; it does not address the extensive use of contract efforts, nor does it consider higher level DoD analyses of this sort). We are not advocating complete centralization of LCCEA for the "need solution stage"; however, we do feel some centralization is needed along with a clearer understanding of responsibilities and interfaces.

References

[1] Lt Gen John G. Albert, "Effective Life Cycle Costing Implementation—The Next Step", *Speech to the AIIE Design-to-Cost/Life Cycle Costing Conference*, 19 April 1978.

[2] P. Stewart, "Life Cycle Cost Management" 3 April 1979 Briefing to Lt Gen Skantze (ASD).

[3] *USAF Summary*, USAF/ACMC, March 1979.

USAF Logistics Policy Insight

Allocating Scarce FY 81 Aircraft Replenishment Spares Funds

The FY 81 funding picture for aircraft replenishment spares is not bright. For the second year in a row, peacetime operating stock (POS) funding falls significantly short of the requirement. With the FY 80 and 81 funding levels fulfilling less than 60% of the requirement, the Air Force has turned to a new method of allocating the funds. To achieve balanced weapon system support, the Resource and Budget Allocation Model (RBAM) was employed as a tool in the decision making process. This model is part of the Logistics Capability Measurement System (LCMS) being developed by HQ USAF (LEX). The RBAM model was employed to determine the mix of spares, within the expected FY 81 POS funding ceiling, to obtain balanced weapon system support. Essentially, the model produced funding levels to achieve equal supportability rates for aircraft with System Essentiality Codes one and two, e.g., B-52, C-135, C-5 and E-3. All other aircraft were funded equitably at a lower supportability rate.

FY 81 Air Force Energy Goals

The FY 81 Air Force Energy Goals announced by the Air Force Energy Office apply to both mobility operations and installation operations and are stated as follows:

- Maintain aviation fuel consumption at or below the FY 75 level.
- Reduce Facility Energy use by 12 percent in BTU per square foot as compared to FY 75.
- Reduce automotive fuel consumption by six percent as compared to FY 79 or zero growth from FY 80, whichever is lower. The facility energy goal is an Air Force goal and does not apply to individual commands. The command objective should be to use the goal if appropriate or if helpful in achieving an overall reduction of 20 percent in BTU per square foot by FY 85, as compared to FY 75.

Satellite Communications During F-4 Deployment to Egypt

During the recent deployment of F-4 aircraft from Moody AFB GA to Cairo West, Egypt, the AF tested (for the first time) the use of satellite communications between a deployed unit and its home base supply organization. The U1050-II at Moody was linked via AN/TSC-94 mobile ground satellite terminal to a DCT 500 slow speed remote in Cairo. Thus, supply support was maintained to a distant, austere location without established complete stocks overseas and moving all the normal complement of people and equipment. This exercise demonstrates the benefits of dedicated logistics communications and flexible ADP systems.

Beyond MMICS: Dover AFB's Automated Maintenance System Test

The Automated Maintenance System (AMS) Test Program consists of developing and testing 19 automated maintenance management processes on the existing C-5 Aircraft Ground Processing System at Dover AFB, Delaware. It is intended that the more beneficial and cost-effective features of each function, once evaluated, be incorporated into future standard system design. At this time, the AMS Test Program represents the only major Air Force effort for identification and justification of future base-level maintenance ADP support beyond MMICS. The first five test increments have been developed and implemented at Dover AFB.

SATO Saves— Soon More of Same

Early results are in from the Traffic Management Office/Scheduled Airline Ticket Office (SATO) Enhancement Program highlighted in this department in the Fall 1980 issue and the savings are substantial. Essentially, SATO is designed to ease the job of buying airline tickets while saving money through discount fares. Experience gained at Wright-Patterson, Scott, Keesler and Lowry AFBs, has clearly proven the concept. The statistics at Scott AFB in September 1980 included:

Total Passengers	1541
With Discounts	397 (25.8%)
Total Cost	$466,268
Savings	$ 44,486

Savings at WPAFB during the first nine months of 1980 exceeded one million dollars. At least twenty more bases will implement the program within the next few months. The Air Force is studying, with the airline industry, the feasibility of satelliting activities without SATOs on activities with SATOs through teleticketing to extend this cost saving technique to all CONUS installations.

Phase IV Competitive Contracts Awarded

Phase IV is a program for replacing the U1050-II and B3500 computers used today at main operating bases worldwide. The program was initiated in April 1976 and involves the largest ADP acquisition ever conducted within DOD with a life cycle cost of $2.5 billion. A unique acquisition strategy is being utilized which involves selecting two vendors to competitively demonstrate their proposed computers. At the completion of this "fly off," one vendor will be selected for production deliveries. The U1050-II computers will be replaced first in 1982/83 followed by the B3500s in 1983/84. The Phase IV Request for Proposal (RFP) was released to industry during December 1978.

An award to two competing contractor teams, Burroughs/Computer Science Corporation and UNIVAC/Program Resource Corporation, has been made.

Some Use of DPDO Exchange/Sale Proceeds Terminated

The authority to use proceeds from Defense Property Disposal Office (DPDO) exchange/sale of certain classes of equipment (primarily vehicles) to buy replacement equipment was terminated effective 1 October 1980. Based on a GAO report which declared the program to be non-cost effective because of administrative costs, the House Appropriation Committee Report on the FY 80 DOD Appropriation Bill required termination of the program. Termination was implemented by OASD/MRA&L memorandum dated 9 July 1980.

Three-of-nine Bar Code is DOD Standard Symbology for LOGMARS

OASD(MRA&L) established the Logistics Applications For Automated Marking and Reading Symbols (LOGMARS) Joint Steering Group to guide the DOD-wide development and implementation of procedures for the automated marking and reading of all logistics data on items of supply, unit packs, and outer containers. During project development, OSD issued a moritorium prohibiting development of new applications of automated marking and reading unless prior approval was received from OASD(MRA&L). This moritorium was intended to minimize proliferation of applications of various symbologies while the LOGMARS JSG was developing its recommendations. OASD(MRA&L) memorandum of 9 Oct 80 approved the three-of-nine bar code as the DOD standard symbology. This memorandum also encouraged all DOD components to proceed with the development and implementation of logistics applications of automated marking and reading technology. We are now planning to incorporate this technology into our logistics operations and systems design efforts. Identification of high areas of payback (both immediate and long range) budget planning, and appropriate resource allocation are being accomplished to assure that implementation proceeds on an orderly basis.

Supply and Computer-Assisted-Instruction

AF/LEYS has begun an effort to improve technical training for the supply career field by the application of advanced training, hardware and methodologies. One of the key technologies under active review is the use of Computer-Assisted-Instruction (CAI) at base level. The first step in the project is the development of a comprehensive requirement statement based on input from the supply and training communities.

Continued on page 17

An Evaluation of Baselining War Readiness Spares Kit Development

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The current marginal analysis method used to develop War Readiness Spares Kits (WRSK) assumes that all assets must be procured. No consideration is given to assets which are already in the WRSK or which may be on contract. As part of the research undertaken at Air Command and Staff College last year, the author sought to determine if the use of a baseline technique could reduce WRSK cost over a period of time without degrading the support provided by the WRSK.

Based on that effort, this article provides background on the current WRSK development techniques, a description of the method used to evaluate the relative effectiveness of a baselining approach and the results of the evaluation.

The Current Method

The use of a marginal analysis or marginal cost-effective technique to compute WRSK requirements had its birth in the 1975 SABER READINESS-DELTA study titled "An Analysis of Concepts for War Readiness Spare Kits." The study analyzed an A-7D and a F-4E WRSK to reach the following conclusion:

> It was found that a more effective and more efficient WRSK could be designed than the ones currently authorized. Consequently, a method was developed for determining the composition of a WRSK based upon marginal cost-effectiveness analysis. The new method was found to permit substantial reduction in WRSK investment costs, with no degradation in the level of support provided by the WRSK. [3:3]

This conclusion became the basis for a live field test comparing the conventional WRSK to a marginal analysis WRSK. The test was conducted at Eglin AFB using two F-4D squadrons consisting of 18 aircraft. The test involved 30 days of flying during a six week period in May and June 1975. The results showed that while both kits could support the flying hour program, the marginal analysis kit provided better support.

> From a standpoint of maximizing sorties and flying hour generation capability, the optimized WRSK was slightly better than the manually computed WRSK in that its deficiencies would have resulted in one less aircraft grounded. Also, the remaining units and a lesser number of zero balances in the yellow marginal analysis WRSK would provide more sortie generation capability in the event of extended use of the WRSK. [22:19]

Based upon the conclusion of the field test, Headquarters USAF directed the Air Force Logistics Command to implement a marginal analysis technique using two weighted parameters. One parameter is the expected number of backorders, referred to as stock due-outs. The other parameter is the expected number of aircraft missing one or more of the items stocked in the kit, referred to as the expected not mission capable (NMC) aircraft. The technique first computes the conventional WRSK and evaluates it in terms of the two parameters, expected stock due-outs (SDOs) and expected NMC aircraft. Then using the marginal analysis technique, it attempts to find a kit having the same level of support in terms of the two parameters but costing less.

The technique basically computes which item to add to the kit to reduce the two parameters the most per dollar cost. It continues adding items until the new kit gives at least the same level of support in both parameters as established by the conventional kit. The technique was briefed to the Air Staff and approval was obtained to implement it. A prototype computer program was implemented in 1977. The production system, called the D029 War Readiness Spares Kit/Base Level Self-sufficiency Spares Computation System, was implemented in April 1980.

The system is capable of computing a WRSK using either the marginal analysis or the conventional computation. To date the F-15, KC-135, A-7, F-4 and E-3A have conducted WRSK/BLSS reviews using the new system. Of these five weapon systems only the KC-135 uses the conventional computation. While the system has some "growing pains"—as expected with any new system—indications show it to be a big improvement in reducing manual efforts and in saving time required to complete the WRSK/BLSS review cycle.

Computation Technique

As stated before, the conventional WRSK sets the support level for the marginal analysis kit. The conventional kit is developed by multiplying the historical failure rate, expressed in demands per flying hour, times the flying hours the kit is designed to support. This result is multiplied times the quantity per application and the results rounded to the nearest integer to determine the expected number of demands to occur during the WRSK support period. Thus, the conventional kit is referred to as the expected demand kit. Once the conventional kit is developed, it is evaluated in terms of the two support parameters, expected SDOs and expected NMC aircraft. Given the support capability of the conventional kit, the marginal analysis technique is used to build the actual WRSK requirement.

Current Computation Assumption

The assumption made in the current marginal analysis technique is that each item being considered for inclusion in the WRSK must be procured. This assumption is seen in the algorithm where the unit cost is used as the divisor to determine the next item to add to the kit. No consideration is given to assets that have already been bought or identified as a requirement. The belief underlying this research effort is that a more realistic approach to computing the WRSK would be to first apply assets which are already on hand before considering which must be procured.

Rationale For Analyzing
A Baselining Alternative

The idea of baselining the WRSK development has never been evaluated. The factor driving the need to evaluate this idea is the method used to compute a marginal analysis WRSK. With this method, item quantities may vary for two reasons. One reason is a change to one or more of the factors used in computing the item quantity. These factors are the mean time between demand (MTBD), flying hour program (FHP), quantity per application (QPA) or the unit cost. A change in one or more of these factors may result in a revised item quantity. The second reason an item quantity may change is the algorithm itself. With this algorithm, item quantities are dependent not only upon the item's factors of MTBD, QPA, FHP and unit cost, but also upon the number of other items and their factors. Thus, adding items to the WRSK, deleting items from the WRSK or changing the factors of the other WRSK items may cause change in a particular item's quantity even though the factors for that item did not change. Severe item quantity fluctuations did occur for some items early in the implementation of the prototype marginal analysis computation model. Since that time *severe* fluctuations have apparently not recurred. However, the fact that fluctuations do still occur warranted an initial analysis to determine if baselining WRSK item quantities from kit to kit can result in a dollar savings by controlling item quantity fluctuations.

The Research

Hypothesis

A baseline technique incorporated into the marginal analysis WRSK computational methodology will provide a WRSK having the same level of support but costing less over a three year period.

Data Base

The F-16 Requirements and Distribution Branch, Directorate of Materiel Management, Headquarters Ogden Air Logistics Center, provided three consecutive year WRSK listings. These listings were for a F-16 squadron consisting of 24 aircraft. The dates of the listings were 15 December 1977, 16 June 1978 and 18 April 1979. The data contained in the listings were the same data used by Air Force Logistics Command (AFLC) to budget, fund, and procure the F-16 WRSK items.

Listing data was transferred to punch cards in the format necessary to run the D029 marginal analysis WRSK computation model. Data extracted from the listing are as follows:

a. National Stock Number
b. Type item (LRU or SRU)
c. Maintenance Code (RR or RRR)
d. Base Repair Cycle Days
e. Total Organizational Field Maintenance Demand Rate
f. Depot Demand Rate
g. Quantity Per Application
h. Work Unit Code
i. Nomenclature

Not all items contained in the listings were used in the analysis. Any item coded as NOP (not optimized) or EOQ (economic order quantity) were deleted from the analysis computed by the D029 algorithm. Instead, the system manager in conjunction with the item specialist and the using command representatives establish these item quantities. These items along with their quantities are them input into the D029 model and carried along to provide a complete listing of all items authorized in the WRSK. Since the item quantities for the NOP and EOQ items are not established by the D029 algorithm, they are deleted from the analysis.

Methodology

To obtain cost comparison figures, the data was first input into the marginal analysis WRSK computation model used by AFLC. This provided the basis of the total cost of buying these assets over the three year period using current procedures. The data was then input a second time to determine the total three year cost of buying assets using a baseline technique. The two total cost figures were then compared to determine if any significant cost savings could have been achieved using the baseline technique.

Assumptions

The following assumptions applied throughout the analysis.

a. Any item quantity identified in a previous year's WRSK is available to be applied to the new WRSK. See item c. below for an exception.

b. WRSK item quantities would have been procured at the stated unit prices.

c. Any item quantity in a newly developed WRSK which is less than the previous year's WRSK quantity would result in a previously procured war reserve materiel (WRM) asset being returned to peacetime operating stock. Items returned to peacetime operating stock would not be available for reapplication to WRM should that item be required in a subsequent year WRSK.

Limitations

The major limitation of this study was sample size. Only one weapon system's WRSK is evaluated and then only over a three year period. This small sample size occurred because there is no requirement for the retention of WRSK listings beyond a two year period. Only the F-16 weapon systems had retained a listing for three consecutive years.

The Analysis

The analysis attempted to determine if a baseline technique could be used to reduce WRSK cost over a period of years. The baseline concept did not revise the algorithm used to develop the WRSK. Rather, it simply changed the starting point of the computation. The current method started the computation by assuming all items must be purchased. However, of the 104 candidate items in the 15 December 1977 kit, 67 of them were also considered for inclusion in the 16 June 1978 kit. Further, as the F-16 weapon system matures, one can expect the items in the WRSK to become more and more stable. That is, fewer and fewer line items will be added or deleted each year. Therefore, instead of assuming each item must be purchased, this analysis used the previous year WRSK to baseline the development of the current year WRSK. That is, the item quantity from the prior year WRSK was used as the starting point for developing the current year item quantity. For example, national stock number (NSN) 1630-01-038-7095 had a quantity of three in the 15 December 1977 kit. The baseline technique begins the computation for the item by assuming that three items are already in the kit. The algorithm then computes the improvement in the two weighted factors of stock due-outs and NMC aircraft brought about by the addition of the fourth unit to the kit.

The Current Computation

After obtaining the card decks for each of the three WRSKs, the decks were input to the D029 Marginal Analysis

Computation Model developed and used by AFLC. As each deck was processed through the model, the results were written to a computer file in preparation for developing a master WRSK authorization file. This master file was needed to determine the cost of buying the authorized spares over the three year period.

The master WRSK authorization file contained the national stock number, item quantity and unit price for each of the three kits. To prepare the master file, a master national stock number list was developed. This list contained each stock number that had been included in any one, two or all three of the WRSKs. These major columns were subdivided into two columns. One column contained the number of units authorized for that particular year's WRSk and the other column contained the associated unit price for the item for that particular year. The format for the master WRSK file is shown in Table 1. Once the master file was built, the cost over the three year period could be determined. Using Table 1 as an example, the cost was determined using these procedures. For the 1977 WRSK, cost was figured by multiplying the unit price times the quantity authorized. In Table 1 the cost of the 1977 kit was $8,746.31. To determine the cost for the 1978 kit, only the cost of the additional items are included. That is, for the first item an additional three units must be procured in 1978. For item number two, no more units are required. For items three and four, an additional fourteen and one, respectively must be procured. Total cost for the 1978 kit is $33,629.19. The cost for the 1979 kit is computed in the same manner as the 1978 kit. That is, only the additional items not in the 1978 kit must be procured. Thus items one, five and six incur costs in 1979. It should be noted that item six has incurred a cost for four additional items, even though five were identified for the WRSK in 1977. The reason for this is that once an item has been returned to peacetime operating stock there is no guarantee that it will be available to satisfy a WRSK requirement a year later. Thus, the third year cost for the F-16 WRSK is $190,437.73. Total cost over the three years for the six items shown in Table 1 is $232,813.23.

The Modified Computation

Table 1 graphically displays the need for evaluating a baseline technique. Using the third item as an example, one can see the authorized quantity change each year. In 1977 the current computation evaluates the effect of adding the first unit to the WRSK based on a unit cost of $1,100.00. In year 1978 the same first unit is evaluated at a unit cost of $1,133.00. In 1979 the cost of the first unit increased to $2,436.00. Thus, the current computation assumes that there are zero assets available for the WRSK. This is true the first year the kit is established, but after that, the majority of items are carried over from year-to-year. For example, of the 104 items in the 1977 WRSK, 67 were carried over into the 1978 WRSK. Of these 67, 46 were carried over into the 1979 WRSK. It seems reasonable to assume that item quantities authorized and carried over from the previous year's kit would have already been funded and procured, or at least be on contract. Therefore, instead of evaluating the first unit of item three at a cost of $1,133.00 in 78, the first unit should be considered as a "free" unit because it was already funded. It is recognized that the assumption of on-hand or on-order is not always true. Still it is a reasonable assumption in view of the high unit of items being carried over from year to year. Thus, one reason for baselining WRSK development is that it is more representative of the situation.

A second reason for baselining WRSK development is to attempt to stabilize item authorizations. Again using item three in Table 1 as an example, one can see an up and down item authorization over the three year period. This up and down change can result from changes in demand rates, unit prices or QPAs. Quantity changes resulting from changes in demand rates or QPA are desirable, to the extent that more or less of that item is now required. Quantity changes resulting solely from unit price changes may or may not be desirable. Consider the case where the asset is already on hand and the unit price to procure additional items increases drastically. If in this case, the authorized quantity is reduced simply because the computation is falsely assuming that the item must be procured, then the change is bad. Baselining the WRSK development with last year's kit would prevent these type of quantity changes but would not affect the other case where the unit price is decreased and the procurement of additional units is desirable as cost-effective.

The most important reason for analyzing a baseline technique is to determine if such a method would reduce WRSK costs over a period of years. Although it is desirable to stabilize the item quantities, and the assumption that previous authorized quantities are on hand or on order is considered to be more realistic, the true determination of need for a baseline technique is dollars. Can such a technique provide the same support at less cost than current methods? To find out, the

Table 1. Master WRSK Authorization File

(Sample Extract)

National Stock Numbers	*1977 WRSK*		*1978 WRSK*		*1979 WRSK*	
	Item Quantity	Unit Price	Item Quantity	Unit Price	Item Quantity	Unit Price
1650-01-039-4983	1	$ 1,947.73	4	$ 1,947.73	5	$ 1,947.73
1660-00-195-2729	2	541.79	2	495.39	1	495.39
1680-01-040-8468WF	1	1,100.00	15	1,133.00	3	2,436.00
5826-01-040-9798	1	11,924.00	1	11,924.00	0	11,924.00
6610-01-044-9400WF	1	-0-	0	-0-	9	20,600.00
6615-00-707-6478	5	923.00	0	-0-	4	772.50
Year's Cost		$ 8,746.31		$33,629.19		$190.437.73
		Total Three Year Cost		$232,813.23		

Table 2. Cost Comparison of Current Method to Baseline Method

	Current Method			*Baseline Method*		
Year	*Cost*	*Line Items*	*Units*	*Cost*	*Line Items*	*Units*
1977	$10,857,338.06	87	768	$10,857,338.06	87	769
1978	10,855,486.05	169	1,061	11,153,636.17	173	1,351
1979	1,858,239.31	117	788	1,425,310.07	108	874

D029 Marginal Analysis Model was modified with a baseline technique.

In the baseline technique the previous year kit was used as the baseline to develop the current year kit. Thus, the 1977 WRSK was the baseline for the 1978 WRSK, and the 1978 WRSK became the baseline for the 1979 WRSK. The 1977 WRSK was the same for both methods, because it was the initial WRSK for the F-16 weapon system. To baseline the 1978 kit with the 1977 WRSK, the item quantity in the 1977 kit was simply overlayed as an initial quantity in the 1978 kit. For instance, NSN 1630-01-038-7095 had an item quantity of three in the 1977 kit. Three units were then used as the baseline for building the 1978 kit. One more unit was added to the 1978 kit. The four units in the 1978 kit were then overlayed to the 1979 kit as the baseline. No additional units were added to that item in the 1979 kit.

If a new item was added to the WRSK, it had a baseline of zero. For instance, NSN 1195-00-025-5657 which was not in the 1977 kit, was added to the 1978 kit and then deleted from the 1979 kit. Any item having a quantity of zero and a unit price of zero was not a candidate in that year's kit. If it had a quantity of zero and a unit price, it was a candidate item, but one which was zeroed out by the D029 model.

With a master file built for the baseline technique, the next step was to determine costs over the three year period, assuming the baseline technique had been used.

Evaluation of Results

The results of the research are shown in Table 2, "Comparison of Current Method to Baseline Method." The 1977 kit was identical for both methods. Of the 104 candidate line items, 87 line items were contained in the kit. A total of 768 units were authorized in the kit. Line item quantities ranged from one unit to 178 units. Total cost to buy the 1977 kit was $10,857,338.06.

The 1978 current method kit was not much different than the 1978 baseline kit in numbers of line items authorized and cost. The current method kit has 169 line items, and the baseline kit had 173 line items. Total cost of the current kit was $298,150.12 less than the baseline kit. This difference was only three percent of the cost of the current method kit. Thus, in line items authorized and one year cost, there was little difference between the two kit development methods for 1978.

The main difference between the 1978 kits was the number of units authorized. The current method kit had 1060 units authorized and the baseline kit had 1,351 units authorized, a 27% increase over the current method kit. One item, NSN 2840-01-018-0473PT, had 178 units authorized in the 1977 kit. In 1978, the current method kit reduced that quantity to 25, while the baseline kit carried all 178 units into 1978. This one NSN accounted for 53% of the 290 unit difference between the two kits. For the remaining line items, unit difference between the two kits were very small—mostly one or two units.

Just as the two 1978 kits were not greatly different, neither were the 1979 kits. Both kits started with 135 candidate line items. The current method kit contained 117 line items while the baseline kit had 108 line items. In 1979, the baseline kit was less expensive by $432,929.24 (about a 23% reduction in cost compared to the current kit). Also, the baseline kit had more units in it than did the current method kit. However, none of these differences were considered to be significant.

Over the entire three year period, the baseline kit proved to be slightly cheaper. It cost $134,779.12 less than the kits developed using the current procedures. This represents a savings of about .6% over the period. Thus, from a cost standpoint, there is very little difference between the two methods of kit development.

One might argue that the baseline kit would provide more support because it had more items in the kit. This may be true for one of the two support parameters used to develop the WRSKs, but it could not be true for both parameters. The algorithm builds the kit to the support level set by the conventional kit. Thus, even though the baseline kits contained more units than the current method kit, in at least one parameter the kits were equal in the level of support provided.

Overall, then, no significant difference, in terms of support level or cost, existed between the non-baseline WRSK developed by AFLC and the baseline WRSK developed in the study.

The big limitation of this study was sample size. A three year period is not long enough upon which to base any broad conclusions. One way to offset that small sample size would have been the evaluation of several different weapon systems WRSKs. However, that data was not available and thus the study was limited to the one aircraft over the one three year period.

Thus, on the basis of an exploratory analysis of a very limited amount of available data, the following recommendations are made with regard to baselining WRSK development at this time:

- No change should be made to the AFLC D029 marginal analysis WRSK computational model; and
- AFLC should retain on a selective basis, certain weapon system WRSK as historical data to be available for studies on ways to improve WRSK computation.

References

[1] AFLC Regulation 57-18, "Management and Computation of War Reserve Materiel (WRM)", 2 April 1979.

[2] TAC Project 75A-012T. *Field Test of War Readiness Spares Kits (WRSK) and Surge Test-Final Report.* November 1975.

[3] United States Air Force, Assistant Chief of Staff, Studies and Analysis. *An Analysis of Concepts for War Readiness Spares Kits—SABER READINESS-DELTA.* February 1975.

CAREER AND PERSONNEL INFORMATION

Key Logistics Assignments Available in 1981

In the interest of helping to provide individual logisticians an opportunity to match their goals and capabilities with their next assignment and to insure that the best qualified volunteers are considered for important logistics positions, the following selected list of key logistics jobs opening during the coming months is published for *AFJL* readers.

For more information on specific jobs, readers should contact the following:

For AFSC	*Contact*	*AUTOVON*
40XX	Major Don Searles	487-4553
60XX	Major Larry Mann	487-4024
64XX	Captain Russ Weaver	487-6417
66XX/0046	Major Bob Pollock	487-5788

AFSC	*Grade*	*Duty Title*	*Organization*	*Location*	*Requirement Month*
6424	Captain	Supply Assistance Program Officer	USAF Southern Division	Howard AFB, Panama	ASAP
6416	Major	Supply Staff Officer	HQ Supt Command (RAAF)	Melbourne, Australia	May 81
6416	Lieutenant Colonel	Chief, Command Equipment Division	HQ Supt Command (RAAF)	Melbourne, Australia	May 81
6416	Major	Logistics Staff Officer	Combined Forces Command	Yong San, Korea	May 81
6416	Major	Chief, Supply Operations Division	Defense Subsistence Region, Pacific	Alameda, California	Jul 81
6416	Major	Chief, Stock Control Branch	Defense Personnel Support Center	Philadelphia, Pennsylvania	Jul 81
6424	Captain	Supply Operations Officer	Air Force Combat Operations Staff (AFCOS)	Pentagon	Jul 81
4024	Captain	Deputy DCM	Peace Pharoah	Cairo, Egypt	May 81
6616	Major	Logistics Staff Officer	Officer of Management Cooperation	Cairo, Egypt	Oct 81
0046	Lieutenant Colonel	Director of Logistics	1605 Air Base Wing	Lajes AB, Azores	Jul 81
6616	Major	Logistics Staff Officer	HQ AFLC/XR	Wright-Patterson AFB, Ohio	Jul 81
6624	Captain	Plans and Programs Officer	Satellite Control Facility	Sunnyvale, California	Aug 81
0046	Lieutenant Colonel	DCS Audio Visual Resources	Hq Audio Visual Services	Norton AFB, California	Jan 81
6616	Lieutenant Colonel	Director of Log Plans Division	314 Air Division	Yong San, Korea	May 81
6624	Captain	Chief Log Plans Division	AF Iceland	Keflavik, Iceland	Mar 81
6016	Major	Transportation Staff Officer	Western Area MTMC	Oakland, California	Spring/ Summer 81
6016	Lieutenant Colonel	Transportation Staff Officer	Eastern Area MTMC (Personal Property background preferred)	Bayonne, New Jersey	Spring/ Summer 81
6016	Major	Transportation Staff Officer	HQ MTMC	Baileys Crossroads, Virginia	Spring/ Summer 81

6016	Major	Transportation Inspector	AFISC	Norton AFB, California	Spring/ Summer 81
6016	Maj/Lt Col	Transportation Staff Officer	CESMET	Tyndall AFB, Florida	Spring/ Summer 81
6016	Lieutenant Colonel	Transportation Staff Officer	Combat Logistics Division	Pentagon	Spring/ Summer 81
6016	Major	Transportation Staff Officer	HQ ANG	Andrews AFB, Maryland	Spring/ Summer 81
6016	Major	Transportation Staff Officer	Joint Traffic Management Agency	Oberursel, Germany	Spring/ Summer 81
6016	Lieutenant Colonel	Transportation Staff Officer	Exercise Evaluation J-5 REDCOM	MacDill AFB, Florida	Spring/ Summer 81
6016	Major	Transportation Staff Officer	Southcom	Quarry Heights,	Spring/ Summer 81
6016	Major	Transportation Staff Officer	HQ United Nations Command	Yong San, Korea	Spring/ Summer 81
6016	Lieutenant Colonel	Transportation Staff Officer	HQ SAC/LGT	Offutt AFB, Nebraska	Spring/ Summer 81
A6016	Maj/Lt Col	Transportation Sq Commanders	Ellsworth AFB, South Dakota Rhein Main AB, Germany Yokota AFB, Japan Osan AB, Korea March AFB, California	Clark AFB Puerto Rico Anderson AFB, Guam	Spring/ Summer 81

560 Selected for Logistics Executive Cadre

The Logistics Civilian Career Policy Council announced the selection of 560 logisticians into the Logistics Executive Cadre at the semiannual meeting of the Council September 8-9 1980. The announcement was made jointly by Mr. Lloyd K. Mosemann II, Deputy Assistant Secretary of the Air Force (Logistics) and Lt General Billy M. Minter, DCS/Logistics and Engineering, Headquarters USAF, Co-Chairmen of the Council. The selectees are considered to have high managerial potential for future positions in Air Force logistics. This selection was one of the key actions necessary to implement the Logistics Civilian Career Enhancement Program (LCCEP) on October 1, 1980.

Competition for selection into the Cadre was extremely keen with many factors considered by MAJCOM selection panels interviewing the candidates. These factors included the candidate's career interest and goals; overall knowledge of logistics; program/project responsibility; initiative/implementing improvements; affirmative action; formal and continuing education, training and involvement in community and/or professional organizations; application of overall knowledge of logistics; and communication ability. Additionally, the candidate's managerial potential appraisal was considered. The initial selection for the Cadre was made from 2,200 candidates interviewed and represents selection Air Force-wide.

The new Cadre selectees will benefit from a number of career enhancement actions, some of which are: priority consideration for management, executive and developmental training; consideration for promotion to Cadre Reserved positions; placement in broadening and developmental assignments; and Air Force-wide top management visibility as a high potential employee. Tenure in the Cadre is for a three-year period. There is no limit on the number of periods that a Cadre member may serve, but the selection process must be repeated at the end of each three-year period. It is anticipated that future selection groups will not be as large as the initial group and that the competition may be even greater.

The Policy Council has top level logisticians and personnelists steering the LCCEP and providing program direction. The program is managed and administered by the Logistics Career Program Branch, Office of Civilian Personnel Operations at Randolph AFB, TX. Program directive is AFR 40-110, Vol 4, Logistics Civilian Career Enhancement Program. In addition to Mr. Mosemann and Lt General Minter, the Council members are: J. Craig Cumbey, AF/MPK; Joseph E. DelVecchio, AF/LEX; D. K. Jones, AFLC/LO; Robert Scott, AFLC/DPC; Ferd Maese, SA-ALC/MM; Edward Zschiesche, OC-ALC/MA; Gerald L. Tompkins, WR-ALC/DS; Joseph F. Shimek, Jr., AFSC/LGT; William Holt, MAC/LGS; and R. A. Reaka, OCPO/MPKCL.

Air Force Logistics Command and the Logistics Executive Cadre

Of the 2,200 candidates recently interviewed for possible Logistics Executive Cadre selection, 1,800 worked in AFLC.

Of the 560 initially selected for the cadre, 403 are assigned to AFLC.

In commenting on an important need for AFLC personnel that the program meets, Lieutenant General Richard E. Merkling, AFLC Vice Commander, identified one of the basic benefits of the program for civilian logisticians across the Air Force.

"LCCEP is designed to provide for a variety of broadening experiences which, in themselves, prepare individuals for advancement," he said.

"Results of the recently completed interviews have further substantiated my belief that, although we in AFLC have very capable people accomplishing our logistics tasks, many of them have advanced through a narrow spectrum of logistics functions," he continued.

"This program will afford employees opportunities to broaden and advance through various logistics functions."

Toward that end, the program encompasses positions in plans and programs, acquisition logistics, materiel management, supply and distribution, transportation, international logistics maintenance and logistics engineering.

About 75 percent of the positions centrally managed under LCCEP are in AFLC, and 25 percent are in other commands.

(Based on AFLC LOGNEWS 80-210 and 80-211)

COMPES: Enhancing Air Force Mobility

Major Arnold R. Anderson, Jr.
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Air Force Data Systems Design Center
Gunter AFS, Alabama 36114

The Contingency Operation/Mobility Planning and Execution System (COMPES) is an Air Force automated data system (ADS) designed to enhance USAF operational readiness posture by providing a standard planning system for contingency planning and execution. COMPES directly benefits every Air Force unit that has a mobility tasking. This ADS is being developed by the Air Force Data Systems Design Center (AFDSDC) and the Air Force Manpower and Personnel Center (MPC).

The need for improved mobility procedures has long been recognized throughout the planning community. The Air Force conducts operational planning in concert with the Joint Operation Planning System (JOPS), which requires that a variety of modular force packaging elements be identified and maintained for planning purposes. In the early seventies, HQ USAF developed the Manpower and Equipment Force Packaging System (MEFPAK) to complement the JOPS system. Since the MEFPAK system was designed for the HQ USAF level, each MAJCOM had to devise its own system for storing and using MEFPAK detail data. Over the years, each MAJCOM evolved a system of managing this data both at the command headquarters and at the base level. Some of these systems are manual, some are automated—none are standard between commands.

While the current approach to mobility planning allows great latitude to the MAJCOMs as they respond to their unique requirements, the MAJCOM-unique systems fail to take advantage of those features which are common to all commands. This lack of standardization is costly, inefficient, and causes numerous problems when forces are moved from one command to another. Failure to accurately and rapidly tailor a force deployment package to a particular crisis situation impacts the logistics function (which must deploy unnecessary resources) and uses additional airlift (because of the unnecessary logistics assets). Also, contingency planners must be retrained as they transfer from one command to another.

Problems encountered during the early 1970s in rotations and deployment involving Southeast Asia led to high level concern for the flexibility and capacity of our deployment planning systems. As a result, several mobility problems identified by the Tactical Air Command were reviewed by the Air Staff. The review concluded that the Air Force's inability to quickly communicate and tailor deployment force requirements had historically interfered with the goal of providing a rapid and effective response during contingency operations. The Air Staff directed the development of a standard Air Force mobility system. COMPES is that system.

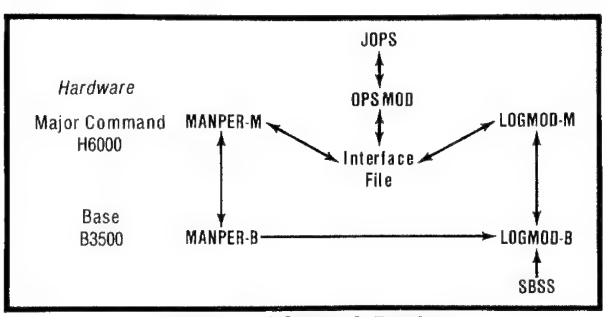

Figure 1. COMPES Design

Overall System Background

System Objectives

The basic objectives of COMPES are to assist Air Force planners at all level to select, deploy and monitor contingency forces in such a manner as to provide optimum response with minimum resource commitment. COMPES standardizes Air Force support of JOPS, standardizes mobility planning and procedures throughout the Air Force, standardizes OPlan execution tailoring procedures, simplifies training of mobility and contingency planning personnel, improves residual capability assessment, aids force allocation, allows better utilization of available airlift and provides automated support for contingency planners.

System Design

COMPES is composed of five separate modules with data flowing among them as shown in Figure 1. The Manpower and Personnel Module-Base Level (MANPER-B) and the Logistics Module-Base Level (LOGMOD-B) provide the contingency planning and deployment capability at base level. The MANPER-B is being incorporated into the base level Personnel Data System. Both modules reside on the Burroughs 3500 computer system. LOGMOD-B is the only module which is batch-processed system. MANPER-B receives data from and passes data to the MAJCOM manpower and personnel module, and relays summary data to LOGMOD-B. The LOGMOD-B also has interfaces with the Standard Base Supply System (SBSS) for automatic updates to National Stock Number information on mobility equipment, and with the MAJCOM logistics module to receive tailoring and tasking data and to pass logistics detail data to it.

At each major command headquarters, the Manpower and Personnel Module-MAJCOM level (MANPER-M), the Operation Planning Module (OPSMOD) and the Logistics Module-MAJCOM level (LOGMOD-M) provide the new capability. All three modules reside on the Honeywell 6000 computer and pass data among one another through an interface file. The OPSMOD relays summary data to the JOPS and accesses several JOPS files to assist in contingency planning. MANPER-M and LOGMOD-M pass data to HQ USAF and to MANPER-B and LOGMOD-B. They also relay tailoring between supported and supporting commands.

Program management responsibility for COMPES resides with the AFDSDC Directorate of Operations Systems with guidance and direction provided by an Air Staff steering committee. Actual development of the OPSMOD, LOGMOD-M and LOGMOD-B modules is being accomplished at AFDSDC by the Directorates of Operations Systems and Logistics Systems. As the representative of the logistics community,

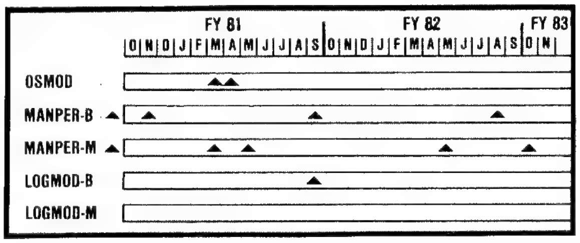

Figure 2. Release Dates For Module Increments

the Air Force Logistics Management Center developed the functional requirement for the logistics modules, and continues to provide consulting services to the project.

System Milestones

As shown in Figure 2, all five modules have various release dates and are themselves being released incrementally. After the requirement for COMPES was validated and development then approved, analysis of each module revealed that incremental development provides a low-risk cost-beneficial approach. Considerations were several: assets that could be applied to the project (functional analysts, systems analysts and programmers), features of each module that were most urgently needed, required interfaces with other modules and with other data systems, and existing data systems that serve for various modules as a starting point. LOGMOD-B is the only exception to the incremental approach, as its features and capabilities cannot be readily subdivided into independent units.

Consequently, OPSMOD has two releases, March 1981 (TPFDD build) and April 1981 (MANPER-M interface). MANPER-B is being released in four increments, from September 1980 through September 1982, with the third increment providing the LOGMOD-B interface. MANPER-M is being released in five increments, from September 1980 through November 1982. The first increment provides a transition from the Contingency Planning and Support Capability (CPSC) to MANPER-M. LOGMOD-B is to be released in one increment in September 1981. Milestones for LOGMOD-M are not yet established, as initial analysis of the task began in October 1980. Milestones are to be established when the System Specifications for LOGMOD-M have been developed.

The Modules

Base Level Logistics Module

The Logistics Module-Base Level provides many benefits for any unit that has a mobility tasking of any size. These are immediately recognizable to anyone who has undergone the travail and trauma of planning for or actually undergoing a deployment. LOGMOD-B standardizes the development process for preparation of unit type code packages, generates reports for MAJCOM, accommodates mobility planning and execution (especially tailoring requirements), interfaces with base level personnel and manpower systems and interfaces with base supply.

Software development and in-house testing will continue through February 1981. In March, the AFDSDC quality control unit will conduct extensive testing of the software and field manuals. If LOGMOD-B passes this test, it will then undergo an extensive and rigorous field test (Environmental System Test-Phase II) at three sites for four months. Commands were selected for field testing based on their totally different mobility missions. Field test sites and their MAJCOM are Langley AFB, VA (TAC), Charleston AFB, SC (MAC), and Carswell AFB, TX (SAC). During EST-II, the three sites will also test the interface between LOGMOD-B and MANPER-B, and between LOGMOD-B and the SBSS. Field testing will conclude at the end of July 1981. In August, the AFDSDC quality control unit will again test the system to insure problems discovered during EST-II have been resolved. The software and manuals will be released worldwide with the 17 September 1981 Burroughs 3500 block release. All Air Force bases with a mobility mission will implement LOGMOD-B beginning in October 1981, according to schedules to be developed by each MAJCOM. After the system has been fully implemented, all existing base-level command-unique mobility systems will cease to exist.

As mobility missions differ significantly from one unit to another, and because the level of mobility experience also differs dramatically from one logistics plans function to another, system familiarization may be traumatic for some. LOGMOD-B is a sophisticated system providing logistics planners many options and capabilities never before available. To overcome this initial problem, a series of orientation workshops are planned. These will be three days each at six different locations worldwide. Invited to attend will be logistics planners (mobility officers and NCOs) and personnel contingency planners. The workshops will be conducted by a logistics planner and a personnel planner. These workshops will be held at Langley AFB, VA, Offutt AFB, NE, Travis AFB, CA, Clark AB, PI, Ramstein AB, GE, and RAF Mildenhall, UK during August and September 1981. These workshops will provide detailed discussion of data base management options and concepts, input transactions and output products.

MAJCOM Level Logistics Module

Present plans are for the Logistics Module-MAJCOM Level to be developed in at least three increments: LOGFOR, LOGPLAN, and LOGSTAT. As the detailed systems analysis progresses this plan will be refined. The primary design objective is to standardize the various MAJCOM data collection, storage, retrieval and transmission processes in addition to providing new capabilities. The LOGFOR increment will be an Air Force standard version of the many command-unique systems now in use. It will standardize logistics planning data, both summary and detail. The LOGPLAN increment will automate the process of generating logistics annex detail of a plan. The LOGPLAN increment will provide four principle capabilities: (1) LOGPLAN generation; (2) product generation; (3) tailoring for specific tasking; and (4) preparing tasking data upon OPlan execution. The LOGSTAT increment will permit tracking of deployed equipment and feasibility analysis of plans. Specifically, it will provide these four capabilities: (1) the location of deployed materiel; (2) identification of residual assets to determine a command's capability to support subsequent tasking; (3) a source of data for the feasibility analysis of OPlans; and (4) data to help determine the impacts of changing scenarios.

Operation Planning Module

The Operation Planning Module will provide the MAJCOM operations planner with several capabilities, none of which are now automated. It will assist the MAJCOM operations planner in the timely development of operations plans. The many new automated capabilities include: (1) initial build of a TPFDD using interface data from MANPER-M, UNITREP (the Unit Status and Identity Report which establishes standards for combat readiness ratings), and war and mobilization planning

systems; (2) unit tasking through a Planning Units File; (3) OPlan distribution; (4) control of the data interface between COMPES and JOPS; (5) validate force availability; and (6) produce various products and online displays to aid in operation plan maintenance and execution.

MAJCOM Level Manpower and Personnel Module

The Manpower and Personnel Module-MAJCOM level provides the contingency planner with many new capabilities. It adds to the existing CPSC system to the extent that this MAJCOM capability has been renamed and put under the COMPES umbrella. MANPER-M will provide the following major benefits: generate and exchange unit type code package manpower requirements, process UNITREP personnel readiness data, work annual force-size and wartime manpower planning exercises, develop personnel guidance for fragmentation orders, generate force deployment data for non-unit related personnel and maintain dependent tracking data.

Base Level Manpower and Personnel Module

The Manpower and Personnel Module-Base Level adds contingency planning and deployment capabilities to the existing base-level personnel system. The major features of MANPER-B are as follows: generate and exchange unit type code package manpower requirements, process TDY engagement and sustainment records, provide casualty and residual strength data, generate UNITREP personnel readiness data and capture and maintain dependent personnel data. MANPER-B will also provide data to the LOGMOD-B module.

Conclusion

COMPES will significantly enhance the Air Force ability to plan for contingency operations and execute actual deployments. As a Command and Control application, at certain times it may require a higher operating priority than other computer-resident management systems. Its five modules tie together contingency planners from operations, logistics, manpower and personnel disciplines. In addition to its many other contributions to the Air Force contingency planning community, this interface of the four disciplines may prove serendipitiously beneficial to the Air Force.

Logistics Policy Insight continued from page 8

Recoverable and Waste Liquid Petroleum Policy

A new Air Force Regulation 19-14 dated 16 October 1980 provides procedures for management of recoverable and waste liquid petroleum products. The regulation requires installations to:

a. Comply with Federal, state, local or host nation laws on environmental protection.

b. Effectively manage the recovery and reuse of petroleum products, to obtain maximum benefit to the Air Force.

The regulation further requires all Offices, Major Commands and all subordinate activities to establish and implement operating and accounting procedures for handling recoverable petroleum products.

Lifetime Contractor Logistics Support

For the past two years the Air Staff has been working on a new directive to provide Air Force policy on Contractor Logistics Support for systems and equipment. This AFR 800 Series regulation, nearing final coordination, will address consideration of lifetime use of a contractor for logistics support and the factors to be considered in making a choice of this support method. The regulation is projected for publication in Spring 1981.

European Distribution System

In October 1980, DCS/L&E announced an initiative called the European Distribution System (EDS) that will provide assured wartime distribution of spare parts and engines in Europe. This program is being jointly worked in the USAFE, AFLC, MAC, TAC and AFCC as a sustainability issue. Major sub-elements of the program include updated materiel management policies, assured Logistics Communications Support in war and the Acquisition of an assured airlift capability for these mission requirements.

Office Automation in Supply

During the past year the Supply Policy and Energy Management Division (AF/LEYS) has been investigating the modernization of administrative systems and equipment used in the retail and wholesale supply system. A program has recently been established to formalize this effort and to take a "systems approach" to improving the administrative productivity of supply. This initiative will go far beyond current word processing, electronic mail, micrographics and related technologies to reduce the paperwork burden within the supply functional areas. A new AF-wide table of allowance for "Office Automation" equipment will be jointly developed by AF/DAY and AF/LEY with the supply community being used as the prototype organization. This promises to be a major program for the future, and members of the supply community were briefed at the October meeting of the Standard Base Supply System Advisory Group on current status.

Continued on page 28

Contract Quality Review

The contracting process requires that contractual instruments issued by the Government be of the highest possible accuracy and quality. The Government cannot afford to issue inaccurate, sloppy, or ambiguous contracts. To do so would weaken the support of the weapon system, cause unnecessary litigation, and raise the cost of the contracting process.

To assure that Air Force contracts are legal, clear, and concise and that fair and reasonable prices are obtained, the Contracts Committee at Ogden Air Logistics Center reviews all contractual documents over $200,000 prior to award and samples documents under $200,000 on a post award basis.

In the past, when Committee members reviewed contractual documents, a great deal of their time was spent recording and preparing their comments for the buyer. In addition, the comments made by different members of the Committee on the same subject matter often differed in content and context based on their various backgrounds. Some comments were made without giving regulatory references causing the buyer to believe that they are simply recommendations. Finally, an inordinate amount of time was spent each month manually compiling the review comments for statistical reporting to the Directorate.

To solve some of these areas of concern, the repetitive comments were standardized (so that each member of the Committee made the same comments about the same subject matter) and loaded into the Administrative Word Processing Center (WPC) (so that the analysts could phone their review in and recall a specific comment by a single alpha/numeric character). One of the Committee members created a reference book of standard repetitive comments covering all areas of contracting (e.g., clauses, levels of approval, determinations and findings, etc.) and giving the regulatory requirement of each comment. A 1-page worksheet was developed for the analyst to "record" the comments.

A great many benefits have been and are expected to be derived from this procedure:

- All comments are standardized without "flavoring" by the individual analyst.

- The analyst's and WPC operator's time is more effectively utilized because they are not writing out and typing repetitive comments over and over, but simply recalling them from machine memory by use of a single character.

- All comments made by the Committee give a regulatory reference.

- The WPC equipment compiles on demand a statistical report which formerly took two to three days to assemble.

- Transferring the recording of comments from the Contracts Committee clerk to the WPC assures that there is always an operator available, whereas formerly, recording of comments could be delayed by the absence of the Committee clerk.

- Time formerly devoted to recording and compiling comments and reports can now be devoted to giving more in-depth analysis and identification of trends.

- The use of the procedure has allowed the development of contract quality standards to measure the Directorate performance.

(00-ALC/PMC, Dan Jones, AUTOVON 458-6591)

CURRENT RESEARCH

Air Force Business Research Management Center (AFBRMC)

The AFBRMC, located at Wright-Patterson AFB, was activated in July 1973 as the Air Force focal point for research into the system acquisition process. The emphasis on research is to develop new knowledge, adopt commercial practices or validate existing knowledge which has direct application to the system acquisition process and will result in monetary savings, procurement of higher quality systems or reduce the time to procure new systems.

The AFBRMC reports directly to the HQ USAF Director of Contracting and Acquisition Policy. Research needs are derived from the MAJCOM's either directly or through the AFBRMC Board of Advisors. Once a need is approved by the Board of Advisors the AFBRMC links the need with a research activity. Selection of the research activity depends on the subject and scope of the need. Research is conducted within the USAF by students in graduate or doctoral programs and PME students, or by civilian activities such as colleges, universities or commercial research firms, through AF contracts. Once the study is complete the AFBRMC is responsible for dissemination of the results and for making recommendations for implementation.

Further information may be obtained by calling the Air Force Business Research Management Center, Autovon 785-6221 (Commercial -513-255-6221).

On-going Research Managed by the AFBRMC

Empirical Determination of the Best Fitting Distribution of WRSK Configuration Analysis
Objective: Undertake an empirical investigation to ascertain during WRSK deployment which distribution patterns most adequately represent spares demand.
(Maj Smith, AFBRMC/RDCB)

Aircraft Modification Management
Objective: To define and prioritize the major problems in managing aircraft modification programs and present a management strategy for overcoming these problems.
(Capt Tankersey, AFBRMC/RDCB)

An Evaluation of the Effectiveness of the Incentive Type Contracts in the Aerospace Industry
Objective: Evaluate the effectiveness of incentive type contracts in the Aerospace industry by evaluating the basic assumptions underlying the concept.
(Maj Golden, AFBRMC/RDCB)

Calculation of Profit on Negotiated Contracts
Objective: Develop a questionnaire to compile data on the degree of contractor satisfaction with present DOD profit policy.
(Maj Golden, AFBRMC/RDCB)

Source Selection, Monitoring and Contractor Past Performance
Objective: Describe and assess the use of contractor past performance information by industry and non-military government agencies.
(Maj Golden, AFBRMC/RDCB)

Business Outlook
Objective: Develop the format and content for a document which provides a summary, in-depth business outlook for the defense aerospace industry to be published on a regular basis.
(Maj Golden, AFBRMC/RDCB)

Effectiveness of DOD Profit Policy
Objective: Explore various DOD policies designed to promote contractor investment in more productive cost effective capital equipment for use on government contracts.
(Maj Golden, AFBRMC/RDCB)

Comparison of Government and Commercial Solicitation Practices
Objective: Review existing literature on subject to identify issues which impact the efficiency and cost of government solicitation for off-the-shelf items.
(Maj Golden, AFBRMC/RDCB)

Analysis of Disputes/Protests
Objective: To investigate, document, and recommend solutions for the problems that have led to protests and disputes.
(Maj Golden, AFBRMC/RDCB)

An Analysis of Critical Materials and Parts
Objective: To identify the short and long term issues and implications of availability and to provide the Air Force with a capability and to provide the Air Force with a capability to forecast and react to potential shortages of materials.
(Maj Smith, AFBRMC/RDCB)

Inflation Accommodation
Objective: Study the underlying causes and nature of price changes being experienced by AF contracts. Understand the industrial base and based on the information, improve negotiation strategies in our inflationary environment.
(Maj Golden, AFBRMC/RDCB)

Model to Evaluate and Predict Impact of ICAM Decisions on the Aircraft Industry
Objective: Develop a model to determine the impact of decisions to invest funds in Integrated Computer Aided Manufacturing (ICAM) equipment.
(Maj Smith, AFBRMC/RDCB)

Special Tooling/Test Equipment
Objective: Conduct a descriptive study on the problems in requirements of special tools and test equipment in support of major AF systems acquisition.
(Maj Smith, AFBRMC/RDCB)

Cost Effective Modernization of the AF Heavy Press Industry
Objective: Investigate the history and adequacy of the AF heavy press industry. Determine criticality of the press in today's and future weapon system procurement. Examine replacement costs and recommend a cost effective method for providing DOD contractors with new presses.
(Maj Smith, AFBRMC/RDCB)

Managing Uncertainty
Objective: In every major system acquisition the project manager must review and assess the uncertainty confronting the acquisition. How this uncertainty is perceived, assessed, and approached has never been accurately determined. This study is to develop a "baseline" for current approaches applicable to managing uncertainty in acquisition.
(Capt Tankersley, AFBRMC/RDCB)

An Analysis of Success in Systems Program Management
Objective: Determine how program success should be defined, which programs were successful and why, and what changes should be considered to enhance chances for acquisition strategy success.
(Maj Smith, AFBRMC/RDCB)

Valid Criteria for Scheduling Techniques
Objective: Develop criteria and procedures to determine proper scheduling techniques for use in planning and managing system acquisition.
(Capt Tankersley, AFBMRC/RDCB)

How to Make Termination for Default Actions Stick
Objective: Identify terminations for convenience which were initiated as default actions. Those actions so identified should be researched to determine the reasons the conversions were made. After the reasons are identified, formulate criteria and procedures to avoid future occurrences.
(Maj Golden, AFBRMC/RDCB)

Air Force Logistics Command FY81 Logistics Research Program

In Air Force Logistics Command, the Directorate of Management Sciences (XRS), Deputy Chief of Staff Plans and Programs, is responsible for developing, managing, and executing the command's logistics research program in the area of management sciences.

The following goals are included in the logistics research program for FY81. First, support Logistics Command initiatives through application of operations research methods through organic and contract studies. Second, design and implement a revised wartime requirements and capability assessment system. Third, extend modular jet engine opportunistic maintenance concepts to fleet-wide applications and implement new developments in engine capability assessment methods. Fourth, support improvements to cost-oriented resource estimating models and improve AFLC data input to the Cost Analysis Improvement Group.

The FY81 program consists of both organic and contract studies in the area of logistics management science. Selected on-going studies for FY81 are addressed below. Additional projects are under consideration at this time. Requirements for consultative services in areas other than those listed will be undertaken as Logistics Command needs dictate.

Selected Studies

Fleet Forecasting Model
Objective: To develop a model to forecast modular aircraft engine removals of both engines and modules, considering life distributions, life limits, inspection policies, and age of population.
Lead Analyst: Captain John Hirn (AUTOVON: 787-7408)

Aircraft Engine Readiness Exercises
Objective: To adapt and apply the JEMS (Jet Engine Management Simulator), TJEMS (Transport JEMS) and MJEMS (Modular Engine JEMS), to given aircraft as necessary in order to measure aircraft downtime due to lack of engines.
Lead Analyst: Mr. Harold Hixson (AUTOVON: 787-7408)

F-15 (F-100) Engine Requirements Evaluation
Objective: To evaluate the engine logistics readiness for the F-100 engine in the F-15 aircraft. Determine the impact of a dynamic scenario on the weapon system readiness using currently computed requirements under current wartime assumptions. Evaluate an alternative proposed requirement package under more realistic wartime assumptions.
Lead Analyst: Mr. Curtis Neumann (AUTOVON: 787-7408)

Dyna-Metric Model Implementation
Objective: To evaluate the logic of the Rand developed Dyna-Metric model and implement it on the CREATE system to make it available for AFLC users.
Lead Analyst: Mr. Curtis Neumann (AUTOVON: 787-7408)

AFLC Simulator Management Location Effectiveness Study
Objective: To determine the effectiveness of collocating the management responsibilities for the Aircrew Training Device/Simulator equipment with their respective weapon system SM (system manager) as a means of resolving the lag time between the modifications of the Aircrew Training Device/Simulator and its respective aircraft.
Lead Analyst: Dr. William Dickison and Mr. Newton Foster (AUTOVON: 787-7408)

Weapons System Support Costs (WSSC) Study - VAMOSC II
Objective: To perform an in-depth review of the WSSC portion of VAMOSC II to determine the integrity of system inputs, algorithms used and output products suitability to fulfill the cost analysis improvement group requirement.
Lead Analyst: Mr. Hugh Hunsaker (AUTOVON: 787-7408)

Defense Logistics Agency Response to Supply Support Requests Submitted by AFLC
Objective: To investigate supply support request submitted procedures to develop improvements in order to reduce negative advice codes on requests returned from DLA. To determine the necessity of returning all supply support requests for common and military standard items reported as stock at DLA but as interchangeable items. To investigate initial spares support list items that have been reported available and that have been depleted by the time demand generates to provide a method change that will offer some assurance of later availability.
Lead Analyst: Mr. Hugh Hunsaker (AUTOVON: 787-7408)

War Readiness Materiel Requirements System
Objective: Investigate alternative mathematical objective functions as they relate to our ability to:
a. Determine recoverable item assets required to support a contingency.
b. Determine the day-to-day ability to support a specific war scenario, as a function of recoverable item assets.
Lead Analyst: Captain Tim Bridges (AUTOVON: 787-4239)

Study of Failure Models - Phase II
Objective: To compare the accuracy of various mathematical models for predicting failures of F-15 recoverable items.
Lead Analyst: Major Don Pederson (AUTOVON: 787-4239)

Wartime Requirements and Capability Assessment Task Group
Objective: To recommend, design, and implement an improved reparable spares wartime requirements computation and capability assessment system.
Lead Analyst: Mr. Vic Presutti (AUTOVON: 787-4239)

Selected Contract Studies

Engine and Module Removal Rate Dependencies (Multi-Phase Contract)
Purpose: Measure aircraft engine module removal rate dependencies and identify changes required to data collection, storage, and retrieval systems and to requirements computation and opportunistic screening policies when the dependencies are considered.
Monitor: Mr. John Madden (AUTOVON: 787-7408)

Simulator Support Study
Purpose: Life Cycle Support planning for commercial computational equipment in Aircrew Training Devices.
Monitor: Mr. Herbert Walter (AUTOVON: 787-7408)

Embedded Computer System Logistics Preparedness During the 1980s
Objective: To develop a long-range plan for use by HQ AFLC to manage and maintain embedded computer systems on a command-wide bases in the 1980s.
Monitor: Mr. Don Casey (AUTOVON: 787-7408)

Long Range Logistics Management System
Objective: To recommend approaches for identification of long-range logistics management systems requirements to support subsequent, functional, Logistics Managment System design.
Monitor: Miss Mary Oaks (AUTOVON: 787-4406)

Consultative Service Areas

Weapons Systems Capability Assessment Modeling
Recoverable Central Leveling System (D028)
Variable Safety Level Model Enhancements
Management and Industrial Engineering
Requirements Computation Services (D041)
Operation and Support Cost Modeling (Macro Models)
Weapons System Component Failure Modes
Dynamic Resource Requirements Analysis
AFLC Logistics Needs Program (Management Sciences OPR)
Computer Graphics
GPSS, FORTRAN, and SIMSCRIPT Modeling
Engine Health Monitoring Systems

Most Significant Article Award

The Editorial Advisory Board has selected, "The Logistics Challenges of Deploying a CONUS Joint Task Force" by Major Stephen G. Crane, USAF, as the most significant article in the Fall 1980 issue of the *Air Force Journal of Logistics*.

A Foundation for an International Logistics Language

Colonel Hussam Abu Ghazealh
Director of Maintenance
Royal Jordanian Air Force
Amman, Jordan

Ardel E. Nelson
Chief, Resources Management Branch
Directorate of Distribution
Sacramento Air Logistics Center
McClellan AFB, California 95652

Background

An increasingly important part of the logistics business of the United States Department of Defense is the support provided to the military services of other countries. Tracing its current history from the "Lend-Lease" policies of the Roosevelt administration in World War II, almost every succeeding year has seen an increase in the size and scope of this "International Logistics" effort. Changes in administration, program changes, a shift from the "free" Grant Aid supplies, for our war impoverished allies and developing nations, to the "pay-as-you-go" Foreign Military Sales portion of the Security Assistance Program—all, regardless of intent, have taken place with little impact on the continual growth of international logistics [9:64-70]. By 1979 the USAF's portion of this program dealt with every aspect of logistics from routine supply of simple spare parts, to major weapon system acquisitions with total dollar values in the billions of dollars. Specific growth of the Air Force effort in international logistics is shown in Table 1.

Table 1.

Overall Growth of USAF FMS Cases with a Value Greater than $100,000 FY 1968–1979*

Year	*No of Cases*	*Year*	*No of Cases*
1968	159	1974	389
1969	155	1975	375
1970	192	1976	451
1971	350	1977	409
1972	270	1978	461
1973	284	1979	475

*AFLC HO 51 Data System

By 1979, the actual number of aircraft being supported in allied air forces exceeded those supported in USAF [30].

Each of the actions to establish and continue the support to allied nations required multiple transactions. Each transaction involved communication.

Due to the complexity of logistics itself, combined with international considerations, this communication involved a variety of types of documentation at varying levels of difficulty. Beginning with the basic international agreements expressed in Memorandums of Understanding and Letters of Offer and Acceptance, and continuing through the increasingly detailed and technically complex financial reports, requisitioning guidance, status reports and detailed procedures, each document represents an effort to communicate. Some of these documents, in turn, created a need for, or were intended to cause, other communications/documents to enter the channel. These included forms, technical orders, procedures and policy statements, automated system interfaces and outputs, all in an ever increasing number and level of complexity. By 1979, the Air Force Logistics Command alone employed almost four thousand manyears of effort to manage and support this effort [24].

Communication is the central core used to implement the various logistics transactions. Lack of clear communication, or ambigious communication, will, as in any business situation, ultimately result in loss of time, money and effort [17:iii]. Unfortunately, as a review of the area, or discussions with managers in international logistics demonstrate [32], such misunderstandings have occurred far too often.

The International Technical Communication Problem

Communication and communication problems have become an increasingly studied subject in both the business and military fields during the past several years. It is well understood that "Communication is the binding agent of all social systems and subsystems [41:3]." Unfortunately "Communication failures are perhaps more frequent than communication successes in the lives of all of us [41:3]."

Difficulties in communication, regarding the meaning of words and terms, are well documented in such studies as Osgood, Suci, and Tannenbaum's *The Meaning of Meaning* [28] that discusses the development of distinctions among the various attempts to define "meaning."

Noting the confusion among lexical, semantical, and psychological definitions [28:3-30], the work proposed a new quantitative measurement of meaning, called semantic differentiation, and establishes a scale to actually measure levels of understanding. Of importance, is the appearance of the term "referent meaning," which establishes that the understanding of a term, in its context and referent surroundings is the preferable goal or measurement index to establish that "meaning" is mutually attained between the message sender and the message receiver/interpreter [28:321].

As Bernice Fitz-Gibbons has stated:

> Psychologists have discovered that we think with words. We don't have thoughts and then seek for words to express them. We have to have the words first. Then we can think the thoughts [16:19].

And of words, there is no shortage in English, as there are over 450,000 words in a single dictionary and more could have been included [39:5a]. The ever changing context of English language technological terms continues to bring in new words and terms, e.g., television, etc.

It is, in fact, precisely in this wealth of words and their use, whether in international business communications, military oriented documents, or requirements determination for software systems, that contemporary studies identify the problem.

In international business communications an American Management Association study [15] noted many misinterpretations and communication failures caused by differentiation of background and perception of the "referent meaning." John W. Enell, AMA Vice President for Research [15:5] noted in the study:

> Man has broken the sound barrier and has crossed many hurdles, but he has not yet learned to overcome the greatest barrier of all—his limited ability to exchange ideas with his fellow men. He tends to be short sighted, resistant to unfamiliar concepts, skeptical and on occasion irritable. These reactions are intensified by distances, language and cultural differences, economic variables and many other factors.

The study concluded, from its survey of 143 executives in fifty-five companies, that communication continued to be a major problem in international business.

A similar observation is made by Haney regarding the difference between progress in the technological aspects of communication vs. improvement in the communication of meaning.

> Quantity, speed and coverage, however, are not the only requirements of communication. It is also imperative that we communicate clearly and precisely. But progress toward greater understandability has come much more slowly than the technological improvements [18:].

The problem of adequate and nonambiguous communication of technical and scientific data, with a proposed solution, is discussed at length by Dr. Russell L. Ackoff in *Designing a National Scientific and Technological Communication System* [1]. The effort, sponsored by the National Science Foundation, contains among its concluding recommendations that an international, common language be developed. Dr. Ackoff cautions that without such an international communication medium there could not be an effective international technological communication network [1:101].

The Military Problem

In documents oriented to military ends, there are also continuing problems. A thesis by Berry and Petersen, dealing with the international logistics agreement to sell RF-4 aircraft to the Federal Republic of Germany, noted confusion over the Memorandum of Understanding wording of contract types:

> . . . The agreement used incongruous, non-quantitative parameters, such as 'best effort by . . . ,' 'competitive,' 'support as far as possible,' 'preferably,' and 'willingness,' in establishing the policies [2:35-36[.

The incident of the RF-4 is not isolated, however, and similar terms and misunderstandings can be found in more recent documents, such as the Memorandum of Understanding on the F-16 [36].

Problems are not isolated to the international environment. The U.S. Army, for example, is experiencing difficulties in producing adequate manuals (i.e., understandable directions). Their studies [42:6] have identified the narrative English text as the main problem and they [42:9] have concluded that "literary writing is not capable of describing a technical object." To date, they have not developed a solution. They are using "cut and try methods" to develop readable technical manuals. These methods require elaborate readability controls, involving numerical criteria for word and sentence lengths. Still, they have not been able to produce predictable results [42:9]. This is similar in approach and results to the Air Force "Fog Analysis" effort to reduce the number of multi-syllable words written in the belief that the reading grade level can be related to the percentage of one syllable words in a given document. According to this theory, the higher the number of one syllable words the lower the reading grade level and higher the understandability.

Frank J. Wojcicki, C.P.L., Supervisor of Technical Logistics Data Quality Assurance at Headquarters USAF, [42:15] notes what is needed is ". . . a recognized defined basic word dictionary and a formalized rigorous industrial engineering method approach to task definition and performance."

He further states [42:9] "to change the reader to fit the technical manual is a monumental problem. Therefore the technical manual must be changed to conform to the reader's capability."

Attempts to simplify and standardize the military vocabulary, whether for specific technical applications or for general logistics applications are part of the ongoing effort to improve communications. Perhaps the principle work in the standardization of overall logistics terminology is that done by Frederick Gluck (Col. USAF, Ret.), whose *Compendium of Authenticated Logistics Terms and Definitions* gathers together over eight thousand terms and three thousand abbreviations that the DOD uses in logistics [17]. This is a long way, though, from the goal of an eight hundred word model, to be used in procedurally structured sentences, with graphics assistance, called for in the prior cited work on Army publications [42:13].

Potential Answers

Structured Analysis

Nowhere, perhaps, is the exploration of this communications problem area more evident than in the discipline of software research and development. For years both business and military have been experiencing both cost overruns and outright failure in the development of software systems [35:1]. The use of ambiguous language, the inability to communicate, and basic misunderstandings of words and terms are seen as the principal causes of the difficulties [35:1, 5, 8; 13:10; 27:10, 11; 40:264].

Stephens and Tripp [34:101], writing on means of expressing requirements, state:

> Words, graphics and mathematics are widely recognized as the basic elements of communication. Words alone offer a poor choice for portraying the structure of relationships present in client needs and wants.

Victor Weinberg [40:48] states, "As the logical rules increase in complexity, English narrative description becomes less acceptable as a specification tool."

And Tom DeMarco [13:11] agrees on the problem, and states:

> . . . factors contributing to the communication problems of analysis are:
> 1. the natural difficulty of describing procedure
> 2. the inappropriateness of our method (narrative text)
> 3. the lack of common language . . .

In response to these difficulties, the software industry developed a technology that has come to be known as Structured Analysis and Systems Design. The evolution of this development is described in detail in the works of E. Yourdon and L. Constantine [43:3-15], Victor Weinberg [40:10-34], Tom DeMarco [13:3-35], and Kenneth T. Orr [27:1-35].

Central to the solutions developed was an increasing awareness of the importance of defining process inputs and outputs [27:13-22] and the combination of graphics, definitions, and use of defined terms, in what is called a "structured narrative," all three of which are essential if full understanding of a document is to be an attainable goal [13:31, 32].

In brief, structured analysis requires that:

1. Principal processes and information flows be graphically shown in what is called a "data flow diagram."

2. Actions are shown in a hierarchic (or "top-down") fashion beginning with the general and proceeding to the specific.

3. The most specific action shown is then described using only (1) a controlled, modified form of English known as structured English, (2) decision tables, and (3) decision trees.

4. All terms be rigidly defined, in a specific manner that eliminates ambiguity and redundance [13:30ff, 129-147, 169-226; 27:107ff; 40:150-167].

The goal is to produce a document that is, according to DeMarco [13:32], "graphic, partitioned, rigorous, maintainable, interactive, logical, precise, concise, and readable." Users of the structured techniques have been unanimous in their support of its claimed benefits both in the United States, as in Boeing Company's use of structured technique to develop its Systematic Activity Modeling Method (SAMM) [34], or overseas, as in the case of A/S Kongsberg Vapenfabrikk A. A., of Norway [29:90], where the company stated: "There are many cases where specification omissions or ambiguities, which would have given rise to costly reprogramming after installation, have been caught early."

It is in the area of definition of terms and use of structured English that the theories and applications of structured analysis can be seen to overlap and blend with both contemporary psycholinguistics and the development of what is coming to be called "controlled English."

In structured analysis, according to DeMarco [13:84], "another problem, though, is that unstructured English or any other natural language, is simply not a good mechanism for expressing complex logical thought."

In response, the software industry, in structured analysis, developed structured English, using only the three grammatical constructs of Boolean Algebra: sequence, decision and repetition [13:184].

In a very real sense, this parallels contemporary emphasis in psycholinguistics, and the philosophy of language, on the critical relation of structure and meaning [31:99]. First, there is the recognition that every sentence has two structures, "one in virtue of which it qualifies as a

sentence, the other in virtue of which it has meaning [31:100]."

Next, it is an accepted aim to improve and systematize structure, to make it more apparent, to aid understanding and the accurate transmittal of meaning [31:106-114].

This is precisely what structured English does. In the emphasis on definitions, noted above, one can find in the structured analysis approach a definite subscription to the linguistic/philosophical tenets of Wittgenstein: "If there did not exist an agreement in what we call 'red', etc. etc., language would stop."[38:xxxiii]

Controlled English

Simultaneously with these developments in software technology and linguistics, the commercial equipment world, as typified by Caterpillar Tractor Company, was experiencing similar problems. Their problems centered on transmitting technical instructions and information in the service and maintenance area to international customers and subsidiaries.

In response, Caterpillar Tractor Company [23:38] developed Caterpillar English as "a basic language that enables a company to produce just one English version of much of its documentation." Composed of 784 key, defined words, plus technical terms and illustrations, researchers discovered they could express all their maintenance and service information with this vocabulary alone, as long as it was used in a carefully controlled range of simple grammatical structures [23:38].

Benefits experienced by Caterpillar included not only improved understanding but also reduced language training costs. In thirty to sixty hours, Caterpillar [23:39] stated they could train "operators who previously knew no English to recognize the meaning of documents written this way."

The effort at Caterpillar was so successful that "Caterpillar English" is now commercially marketed as *ILSAM* (International Language for Service and Maintenance) and, in a slightly different form, as *Basic 800* [23:38]. Research is being continued in this area by the Communications Studies Unit of the University of Wales Institute of Science and Technology.

A similar effort, which evolved from the Caterpillar endeavor, was that made by the National Cash Register Corporation (NCR) in the development of *NCR Fundamental English*. NCR "had reached the point that you had to be a technical expert to read our documentation and if you were, you didn't need the document [4]." The principal problems were:

1. multiple names for the same thing,
2. jargon that was understood only by the initiated few,
3. coined words that were given vague and inexact meanings,
4. normal English words given different, technical meanings,
5. use of nouns as verbs, and
6. use of American idioms not understood outside the U.S. [25:1].

NCR also prepared a dictionary, unique both in that the definitions themselves are written in controlled English, and in that the dictionary is tailored to their specific business efforts. The actual vocabulary was reduced to 1350 words (plus technical terms). NCR has prepared their new technical manuals using this vocabulary. The results in the field have been highly satisfactory [4].

The Research

The investigation of the possible utility of the above developments to help solve the communications problems associated with Air Force FMS documents was made by the authors in 1979-80 while attending the Air Force Institute of Technology's (AFIT) School of Systems and Logistics. The rest of this article summarizes that work.

Statement of the Problem

The use of conventional, narrative English is causing difficulties in international logistics support. The problem is the lack of correct understanding of the meaning of the English terms and narratives both in and out of context. This problem is occurring at all levels of documentation, from the initial Memorandums of Understanding and Letters of Offer and Acceptance (DD Forms 1513) down through, and including, Technical Orders and Job Instructions. The importance of the problem is increased by the fact that these misunderstandings and misinterpretations are occurring, not only among individuals, but also among nations.

Research Objective

The objective for the study was to determine if a basis and foundation for an international logistics language, including grammar, syntax, and vocabulary, may be found in the techniques of structured analysis and/or "controlled English."

Research Questions

The following questions were directed at accomplishing the objective of the research:

1. Does the application of state-of-the-art structured systems analysis techniques, developed in support of computer software requirements determination, improve the level of mutual understanding (both within and among the allied nations) of international logistics communications?
2. Does the application of "controlled English," as a vocabulary control mechanism, improve the level of mutual understanding of international logistics communications?

Assumptions

The following assumptions were made:

1. International logistics support will continue for the foreseeable future to be an important portion of the overall U.S. DOD logistics support mission.
2. The English language, in some form, will continue to be the basis for international logistics communication.
3. Interchangeability of technical data and technology transfer will continue to increase in importance in international logistics.
4. International co-production agreements and Cooperative Supply Support Logistics Agreements will continue their increase and their resultant increasing requirement for standardized data.
5. The current trend to automate business/logistics communications and decisions will continue, again increasing the need for standardization to allow for automation of these processes.

Description of the Universe

The applicable universe for the study was the body of personnel directly related to the U.S. Government, DOD Foreign Military Sales (FMS) program, and those who use FMS documents in the performance of assigned jobs, either as direct instructional aids or as reference material. The universe includes both U.S. and allied military and civilian personnel who perform these tasks.

Description of the Population

The population investigated in the study consisted of allied officers assigned to Wright-Patterson AFB as Liaison Officers to the Air Force Logistics Command, allied and U.S. officers and civilians enrolled in the Logistics or International Logistics curriculum at AFIT, students at the Defense Institute of Security Assistance Management (DISAM), and Spanish Air Force personnel assigned to Project Peace Sigma at Sacramento ALC, McClellan AFB. This target population is both a convenience and a judgmental sample. It represented diversity of parent language, varying degrees of comprehension of the English language, varying degrees of logistics expertise, and varying levels of command/management authority in the FMS program.

The Sample

The sample drawn from the population consisted of twenty Allied Officers from the sources listed above and a random sample of twenty U.S. military officers and civilian personnel enrolled in graduate logistics management programs at AFIT for a total of forty tested participants.

Fourteen countries were represented: Australia, Bahrain, Canada, Egypt, Indonesia, Japan, Jordan, Korea, Norway, Pakistan, Spain, Taiwan, Turkey, and the United States.

Native languages of test participants (Arabic, Chinese, English, Indonesian, Japanese, Korean, Norwegian, Spanish, Arabic) represented every continent and most major language groups. Only the language groups of Russian (Slavic), the dialects of Black Africa, India and the former Indochinese peninsula (Burma, Vietnam, etc.) were not included. Overall, test participants had five plus years of experience in logistics with five claiming one year or less experience, nine claiming two to four years, three claiming four to five years and twenty-three over five years. Logistics disciplines/fields represented, and the number of each, are shown in Table 2.

Table 2.
Logistics Experience of Participants

Field	Number with Experience*
Maintenance	11 (5)**
Transportation	2 (2)
Storage	4 (3)
Requirements	9 (5)
Engineering	3 (2)
Acquisition/Contracting	10 (7)
Technical Documentation	4 (2)
Automated Systems	7 (6)
Base Level Supply	6 (2)
None	4 (1)

*Numbers total over forty as some participants identified two or more fields.

**Numbers in parentheses represent participants with native language other than English.

English Speaking

Among native English speakers, the average participant had four to five years logistics experience with three claiming one year or less, five claiming two or four years, two claiming four to five years and ten claiming over five years.

Other Native Language

Among participants with other than English as a native language, the average time for length of logistics experience was over five years with two claiming one year or less experience, four claiming two to four years, one claiming four to five, and thirteen claiming over five years.

As to the degree of English language proficiency among those with a native language other than English, the average length of time that participants had known/used English was five to ten years with five to ten years also being the average time in the past that they had studied English in school. Related to their understanding of specific American idioms, as determined by their length of stay in the U.S., the average participant had been in the U.S. about two years, with five having been in the U.S. for two to three years and only two having been in the U.S. over three years (total).

Data Collection Instrument

The data required for this investigation was generated by means of an experiment. The choice of an experiment is due to the basic advantages and power of such a method in determining relationships, particularly causal, between variables (14:302). The following sub-paragraphs deal, in turn, with the description of the procedure used, variable definitions, and the reliability and validity of the test instrument and collection technique.

Description of the Procedure

First, a representative selection of FMS documents was made, with the assistance of DISAM and AFIT staff personnel, to assure that documents selected were representative of various levels of difficulty of FMS documentation and were considered "good" documents. Documents identified were the proposed Foreign Miltiary Sales (FMS) Customer Guide (Nov 1979 Draft); the proposed revision of Procedure for Reporting Discrepancies Against FMS Shipments (Oct 1978 Draft); 67-1, Air Force Supply Procedures; and a Maintenance Order for the F-5 aircraft.

Second, with the assistance and advice of these same staff personnel, a specific action, paragraph, direction or information entry was selected as representative of the document contents.

Third, in addition to the narrative version, three new versions of these sample documents were prepared, one in structured analysis technique, one in controlled English and one using both controlled English and the structured analysis technique.

The structured version was prepared in accordance with the guidance of Tom DeMarco's work [13]. The controlled English texts were developed using the vocabulary and guidelines of the Caterpillar Company [5, 8]. All test documents were prepared using the same typewriter and format to prevent any confounding effect from this source.

To assure that documents were prepared accurately, and that the techniques were not misrepresented, the controlled English version was reviewed by the Service Training Division of Caterpillar Tractor Company and the structured version by the Yourdon Company. Neither had major suggestions for improvement. Indeed, the Training Materials Editor for Caterpillar Tractor Co. stated "the controlled English version was very good" and he wished others could do as well [20].

Fourth, a criterion test was developed, consisting of ten multiple choice questions for each sample document, seeking specific information about that document. The purpose of the test was to determine if basic understanding of each document was achieved. Each complete test consisted of:

1. Introductory questions to obtain demographic information.
2. One of the above identified documents in its narrative form.
3. One of the documents in "structured analysis" version.
4. One of the documents in "controlled English" version.
5. One of the documents in a version using both structured analysis and controlled English techniques. No test contained more than one version of the same document nor more than one example of each version.
6. Criterion test (ten multiple choice questions) for each document.
7. Following the multiple choice portion, the test contained ranking questions that requested that each subject rate the author's competence as a writer and then rate each author's knowledge of the subject matter on nine point scales.
8. Finally, after all documents had been read and the test completed, subjects would be requested to indicate their preference for the four different types of documentation presented, i.e., to rank them from most liked to least liked.

Fifth, sample population personnel were contacted and briefed on the purpose and nature of the experiment. This briefing included essential guidance on how to read structured and controlled English documents. Briefing contents were identical for all personnel. The initial briefing was purely factual and informational in nature and would not tend to bias results.

Sixth, document versions were randomly assigned to sample personnel, only assuring an equal number of tests for each test series.

Seventh, personnel were provided the test and answer sheets and the test administered under controlled, timed, monitored conditions. The time required for each subject to read each document was recorded in minutes.

The criterion for the measurement of the effectiveness of the various versions consisted of the four measures of:

1. Results of the multiple choice test on comprehension.
2. The time measurements.
3. The judgment of the author's competence as a writer.
4. The judgment of the author's knowledge of the subject matter.

The criterion for measuring the acceptability/desirability of the various versions consisted of the final ranking of the documents at the end of the test.

Variable Definitions

There are two independent variables. The first, related to the objective multiple choice portion of the test, the timing, and the judgments on the author's competence and knowledge, is understandability/degree of understanding, measured/shown by the test. The second is related to the preference question at the end of the test where the participants ranked each of the documents as to acceptability.

The independent variables for the first portion of the test are (1) documentation versions and (2) document identity/subject matter. The independent variable for the ranking and preference portions is the subjective rating of the subject.

Validity and Reliability

The following steps were taken to enhance the validity and reliability of the experiment:

1. The original narrative version was in the test as a control treatment since the general effect of the new treatment was unknown [26:673] and to assure that the tests were truly comparative [26:105].
2. To protect against bias, the assignment of treatments to experimental units was made in a random determined by their uncontrolled pattern of entry to the test room.
3. A complete multi-factor study was chosen to gain knowledge of interactions, strengthen validity and permit valid inferences about the primary factors over a wider possible range [26:551-552].
4. Equal sample sizes were selected for each of the factors to maximize the precision of comparison for each pairwise comparison [26:492].
5. All documents used were selected in coordination with and reviewed by AFIT faculty and DISAM personnel to eliminate or reduce personal bias and to assure context validity of the test material [14:120].
6. The use of a statistically large sample (>30) allows not only the testing of the normalization of response error factors but a consistency of results test to allow determination of reliability [14:123]. Additionally, the administration of four separate tests to the sample forty people yields a duplication of ten for each test. With ten questions for each of the four documents and four versions this will yield a total of forty responses per version and per document and ten overall scores per individual test response cell. In testing normality of residual error distribution, normality can be assumed. This is because factor level sample sizes can be combined for all treatments. The ϵ_{ij} (residuals) for all treatments can be combined into one, larger group and treated as a sample size of forty [26:506].
7. Test data, in addition to being randomized, were blocked, to match equal numbers of personnel with English as their native language and allied personnel with a native language other than English (twenty each) with each experimental treatment applied randomly, to eliminate unwanted sources of variability and assume inferential validity [26:722-725; 3:102-106, 208].
8. Emphasis was placed on the experimental design so that unequivocal answers, with minimal impact of experimental error could be obtained. This will significantly decrease the difficulty in analysis and make many conclusions evident from simple data inspection [3:7].

Data Analysis

Demographic Analysis

An analysis of Table 2, on the general data for all participants, indicates a predominance of experience in the Maintenance and Contract/Acquisition area. The presence of this knowledge would indicate that participants would be anticipated to have an easier time with any documents related to these areas. Specifically, this would be anticipated to influence reaction to, and understanding of, the F-5 T.O. Although, from the U.S. point of view, no document relates specifically to U.S. acquisition/contracting, from an FMS point of view, i.e., looking at the documents from an allied officer's viewpoint, the section from the FMS customer guide must be judged as related to this area. The majority of those claiming acquisition/contracting experience are allied personnel. It could also be anticipated then that this could impact scores achieved on that document, by allied officers. Lastly, a majority of personnel claiming experience in automated systems are allied personnel. Specifically these represent the Spanish Peace Sigma personnel who have been working with structured analysis for about one year. It can be anticipated that this experience would impact their understanding and ranking of structured documentation versions.

As will be seen in the analysis of the test data below, the first of these anticipated impacts was, in fact, able to be verified to some degree. No major impact occurred, though, due to the randomization pattern of document subject and document versions. Specific impacts that did occur are discussed in the sections on the criterion test and rankings. The second anticipated impact (Spanish experience with structured analysis) occurred only in the rank preferences and not in level of understanding data reflected in the criterion test.

Test Results Analysis

This section provides details of the basic approach to the analysis of data generated by the experiment design which was just described. The experiment produced several distinct data groupings for analysis. The first of these was the results of the multiple choice testing. These data were in a form allowing application of two way, multi-factor, analysis of variance techniques. The choice of this specific analysis technique was due to: (1) the well documented acceptance of the block design, multi-factor ANOVA in statistical studies of this type [12:153; 26:551-552; 3:208-241] and (2) the robustness of the model [26:501]. This latter point assures that, even though steps were taken to assure compliance with the model assumptions of normality, independence and equal variance of the error terms (through use of a large sample with addable error terms and independent test by random assignment), the analysis would still be valid if these steps had not been taken or were not done as correctly as possible. This is due to the fact that: (1) for the model, lack of normality is not an important matter and the point estimates of factor level means and contrasts are unbiased whether or not the populations are normal [26:513] and (2) if error variances are unequal the test for equality of means is only slightly affected if all factor sample sizes are equal [26:514] as is being done in this case.

The second group of data, responses to the judgment questions on the author's competence and judgment, was analyzed by simple analysis of variance. Next, the timing data, also analyzed by simple analysis of variance, was used to further analyze the results of the above two types of data and the preference data. Finally, responses to the preference question were analyzed using Kendall's coefficient of concordance.

General Data

The basic data for the criterion test are displayed in Table 3. Numbers displayed at each Factor intersection are the average scores ($\overline{X}$) i.e., the specific μ_{ij}) for that cell. It is the μ_{ij} for the ten individual test scores composing that cell.

From this data the specific factor effects were obtained and analyzed.

The treatment means in Table 3 indicate the level of understanding (as expressed by the criterion test score) was not the same for each document or version. This can also be seen in the row and column averages.

When the specific and main understanding effect by version was measured it was seen that the effect of controlled English, overall, was superior to all others. This is supported by the Table 3 column average $\mu_{.2}$. Following controlled English in order are: the narrative English, structured/controlled and structured techniques.

When the specific and main effects of the different documents was considered, the most understandable of the documents was, by far, the T.O. This, also, is supported by the μ_{4j} and $\mu_{4.}$ data in Table 3. Following the T.O., in order of understandability, were the FMS Customer Guide (significantly below the T.O), the AFM 67-1 RIW Procedure and then the SAAC Discrepancy Procedure.

Some interaction between the factors was determined to be occurring, with the greatest taking place in the T.O. when in the structured/controlled version. In general, the interaction indicator can serve as a guideline as to where the maximum benefit of adoption of one version versus another [26:551-2] exists. Overall, however, testing to determine the significance of the interaction revealed that interaction was not a significant factor, even though it occurred.

Testing to determine if Factor A, the versions, did have a significant effect on understanding revealed that the versions *did* have a significant effect on understanding of the documents, with controlled English having the greatest positive impact.

Structured Technique Results

One of the results that might have been anticipated, as noted earlier, was that the Spanish personnel, who had worked with the structured materials for over a year, would have scored higher in that area. Such was not the case. Once again the ranking was controlled English first, narrative second and the structured techniques a distant third and fourth.

An analysis was made to determine why the structured techniques scored significantly lower than the other versions. Surprisingly, seventeen of the forty participants had higher scores in the structured versions than in the other versions. This would seem to argue that the structured version should have scored higher than the others. That they did not was traced to the fact that the other twenty-three participants who had higher scores in the narrative and controlled English versions had exceptionally low scores in the structured techniques, while those who scored higher in the structured techniques scored moderately well in the other versions. Of those who did score well on the structured documents, only two (11.8%) had maintenance backgrounds. Compared to the relatively high percentage of test

Table 3. Criterion Test Data: Treatment Means

Factor B Documents	*Factor A—Version* $j = 1$ Narrative	$j = 2$ Controlled English	$j = 3$ Structured	$j = 4$ Structured Controlled	*Row Average* i
FMS customer Guides, $i = 1$	$64_{(\mu_{11})}$	$49_{(\mu_{12})}$	$43_{(\mu_{13})}$	$42_{(\mu_{14})}$	$49.5_{(\mu_{1.})}$
SAAC Discrepancy Procedures, $i = 2$	$38_{(\mu_{21})}$	$55_{(\mu_{22})}$	$23_{(\mu_{23})}$	$20_{(\mu_{24})}$	$34_{(\mu_{2.})}$
AFM 67-1, RIW Procedures, $i = 3$	$57_{(\mu_{31})}$	$64_{(\mu_{32})}$	$24_{(\mu_{33})}$	$14_{(\mu_{34})}$	$39.75_{(\mu_{3.})}$
F-5 T.O., $i = 4$	$63_{(\mu_{41})}$	$64_{(\mu_{42})}$	$54_{(\mu_{43})}$	$75_{(\mu_{44})}$	$64.75_{(\mu_{4.})}$
Column Average	$55.5_{(\mu_{.1})}$	$58_{(\mu_{.2})}$	$36_{(\mu_{.3})}$	$37.75_{(\mu_{.4})}$	$46.8125_{(\mu_{..})}$

Table 4. Reading Time Data (Minutes)

Statistics	*Versions* Narrative	Controlled English	Structured	Controlled Structured
$\overline{X}$	7.27	7.26	8.92	9.34
σ	3.421	4.54	4.0781	4.78
σ^2	11.703	20.62	16.63	22.88

participants with a background in maintenance (28%—the highest percentage of all the logistics fields represented) this is somewhat surprising as the second higher group, acquisition/contracting (with 25% of participants claiming experience in the area), represented 47% (eight of seventeen) of those who did well on the structured techniques. Of the Spanish Air Force participants from the Peace Sigma project, 50% (five of ten) scored higher on the structured techniques.

All test participants were observed during the test. It was noted that approximately 50% (twenty-one) did *not* follow the recommended procedures for reading structured documents. This was in spite of the earlier briefing on the proper technique and the instruction itself. Those who did not follow the instructions were observed to exhibit signs of agitation and frustration during this portion of the test and were apparently "lost" in the document, flipping pages back and forth (a definite indication that instructions are not being followed) and frequently looking back at the document text while answering the questions. Eight of these documents were able to be identified after the testing to the test participant (by information volunteered by the participant) and they were among the lowest scoring in the structured techniques. It might be assumed that the other low scores belong to the other participants who exhibited like behavior. The longest time in reading the documents, shown in the next section, was also exhibited by this group.

Time Factor

Basic data for time analysis is shown in Table 4.

As can be seen, there is no significant difference between narrative and controlled English. There is a significant increase, however, between these two versions and the structured version. Among those who scored higher in the structured than in the narrative, the figures are quite different, with all figures falling between 8.1 and 8.8 minutes. This group took less time than the overall average on the structured documents and more on the narrative and controlled English versions. This first (taking less time) is judged as being due to the following the prescribed procedures. The latter (increase in time on narrative and controlled English) is reflected in their scores. As stated above, though their scores on structured documents were better than the other two versions, their overall average, even in the narrative and controlled versions is higher than the general average.

Rating of Authors

As can be seen in Table 5, the overall test group rated the current, narrative English documents the highest. Yet the allied officers (figures in parenthesis) rated it the lowest. Examination of the ratings indicates a strong bias by the U.S. test personnel as the probable source of the group rating. Most (7) of the U.S. raters scored the narrative version at 8 or above and the other versions at 4 or below. That bias (possible resentment at an implied challenge to their language) as indicated is confirmed by their contradictory, higher understanding scores in a non-narrative version. Also differing from the general rankings were those testees who scored best in in understanding on either of the structured versions. These assigned the highest ratings to the structured/controlled versions with 7.25 for competence and 7.92 for knowledge.

Table 5. Author Ratings

Version	Rating Competence	Knowledge
Narrative	6.20 (6.52)*	7.59 (7.53)
Controlled English	5.6 (7.00)	7.20 (8.00)
Structured	4.97 (6.06)	7.13 (7.62)
Controlled/ Structured	5.59 (6.29)	7.13 (7.54)

**Allied Ratings in parentheses*

Preference Ranking for Versions

A version preference ranking was determined by summing the rankings (1 through 4) given each version by the participants. The overall choice was controlled English (with the lowest sum of rankings of 89) followed by the narrative (93), structured/controlled (102) and structured (111) versions. The degree of agreement with this ranking as determined by the statistic *W* (with 1 being perfect agreement and 0 being no agreement) was .5439. The ranking and the degree of agreement with it, were determiend to be statistically significant through use of the "*Q*" test of Neter and Wasserman and the Friedman test for ranked data [26:747-749[.

Some additional comments are in order. Only ten participants ranked narrative English as their first preference and of these only three were allied officers, the target population for FMS documents. Over half of all participants (twenty-four) ranked controlled English as their first or second choice. The Spanish officers split 50/50 between preferring structured or controlled English documents for their first choice. Of the two structured styles, the controlled English/structured version is generally preferred by all participants over the uncontrolled versions. The Spanish officers preferred the controlled English version four to one over the regular structured versions.

Of special interest, however, is the ranking assigned by the target population for FMS documents, the allies. Their preference is different than the overall ranking. It is: first, controlled English, second, controlled/structured, third, structured; and fourth, and last, narrative English. Thus, although there is some disagreement between the total participants and just the allies on how far down narrative English ranks, there is agreement on the first preference, controlled English.

It should be noted that even though the allied officers ranked the controlled/structured version as number two, their objective scores on the criterion test do not show this version as their second highest score. It is believed that the time factor had an influence here. Specifically, all documents were restricted to a total of twenty-five minutes for reading and answering the questions; it took longer to read the structured versions (and allied average times were longer for all versions), thus leaving less time to read and answer the questions. This is borne out in examining the answers given, as the allied officers completed fewer questions for the structured documents than for the narrative and controlled English versions. Removal of the time restraint might have changed criterion scores to correspond to the preference ranking.

Some comments and remarks made by participants may have relevance. Specifically, fourteen participants (allied and U.S.) commented on the benefits and desirability of the dictionary used in structured documents, i.e., they saw a distinct benefit in defining technical terms in that manner versus a "normal" definition. Four of the U.S. participants noted that although reading the structured documents was "hard work," they had greater certitude that their answers were right. They attributed this, in large part, to the definition technique of the dictionary.

Conclusions

From the above analysis, the following conclusions can be drawn, and answers given to the initial research questions.

Question 1 asked if the application of structured analysis techniques would improve FMS documents.

The answer must be: No. Data does not support such a change. Such techniques are apparently better left to the analysts, as the data and analysis do not support improved understanding in these methods. As stated in the analysis section, this may, in part, have been due to the time restraint. One side benefit to this general technique, however, can be noted. In the development of the alternate versions of all the documents, the requirement to place them into the structured format did force several changes in the choice of documents to be used. This is precisely because of the method's strength as an analysis tool, i.e., initial structured versions frequently identified major errors and shortcomings in the original narrative document being converted to structured format. Development of the data flow diagrams revealed missing information, information not being provided when required, redundancy/duplication of effort, non-use of some information required by another section of the document, incomplete specification of required actions, etc. Knowledge/use of this technique to analyze a proposed document to be produced in any format or version would lead to clearer, more complete and logical documents.

It can also be concluded from the comments of participants, that the structured definition technique of defining terms by their component elements is a beneficial element of structured analysis, with benefits that seem transferable to other than structured documents. This will be further discussed below, under recommendations.

Question 2 asked if the application of controlled English would improve FMS documents.

The answer is a definite yes. All data and analysis supported the conclusions that:

1. Documents are significantly more understandable when written in controlled English as opposed to either conventional narrative English or the structured techniques, and
2. Documents in controlled English would be preferred to documents in narrative English.

Both conclusions are further strengthened when one isolates the responses of the allied participants. Then it can be concluded that:

1. Regardless of language group, a change to controlled English will result in more understandable documentation for our allies.
2. Such a change (based on the preference rankings) would be welcomed by our allies.

Additionally, the analysis indicates that such a conversion would be beneficial to the reader, regardless of logistics background, i.e., beneficial to those with maintenance backgrounds as well as acquisition, etc., thus demonstrating applicablity

to all FMS documentation: policy, procedures and instructions, all of which were represented in the sample documents.

Recommendations

In so far as the FMS program is itself a tool for the furtherance of U.S. foreign policy, then any action that would make the FMS program more acceptable to the allies, and make the program more efficient, must be seen, in turn, as contributing to the furtherance of U.S. foreign policy.

Test data, data analysis and conclusions of this paper do, in fact, show that the adoption of controlled English for FMS documentation would be such an action. The basic recommendation, therefore, supported by this project, must be that action should be taken to allow FMS documentation, from policy documents to maintenance manuals, to be written in controlled English.

This general recommendation can be separated into the following more specific recommendations:

First, that the voluntary vocabulary for a "Logistics Fundamental English" version of controlled English be developed.

Second, that a basic set of grammar and syntax rules be formulated.

Third, that a dictionary be developed to contain the vocabulary and rules and serve as a basis for training.

Fourth, that training materials be developed to teach FMS documentation authors how to use controlled English.

Fifth, that a specific plan be developed to allow conversion from the current procedure to the new use of controlled English with a minimum loss of time and with a minimum expenditure of resources.

There are three possible scenarios in which Logistics Fundamental English can be developed:

1. The Air Force can make the decision to implement it on USAF cases and proceed accordingly.
2. The proposal can be recommended to either DOD level, or the Joint Logistics Commanders. They in turn can designate an action agency and then proceed accordingly.
3. The proposal can be made as in "2" but with the additional recommendation that the Air Force, and within the Air Force, the Air Force Logistics Command, serve as the implementing pilot/action agency to develop the vocabulary, grammar and documents noted above, coordinating such an effort with the other services' logistics commands.

Though distinct benefits and drawbacks can be found with any of the three proposals, it is believed that maximum benefit would accrue through the adoption of "3" above. This is due to:

1. The initial experimentation and proof are based on USAF experience and validated with allied Air Force personnel.
2. It is believed Air Force FMS cases offer a wider range of technologically diverse projects (from simple spares support to management and automated systems development to sophisticated weapons sales/support) that would assure development of a vocabulary from a wider sample base.
3. Some experience in dictionary development and terminology standardization in an FMS environment is already resident in AFLC through their current efforts in the development of logistics management systems for FMS customers, e.g., Peace Sigma.

Development Team Approaches

First, it is possible that the entire project could be contracted out to one of the several firms with experience in this area. While potentially increasing the cost, it does offer the benefits of maximizing existing experience with a minimum commitment of Air Force (or DOD) personnel. It also presents the possible draw back of losing the commitment of an internally staffed effort and the insight of professional logisticians as to their actual needs.

Second, as the entire concept is to further the understanding in the area of FMS, it is possible that a multinational team, under the leadership of two or three U.S. personnel, and, if required, with the assistance (contract) of companies with experience in this area, be charged with the development effort. Based on the response to this thesis topic from allied officers at AFIT and AFLC, it is believed that there is sufficient interest in improving FMS communications and that such a team could be assembled. Ideal composition might include one or two officers from each of the major language areas tested (e.g., from the Middle East, from the Far East, Europe, etc.). This would allow, not only the development of a more universally accepted vocabulary, but obtain a co-commitment on the part of the allied countries to work for better communications. Additionally, such cooperation could be seen, in itself, as another means of furthering U.S. foreign policy and strengthening ties between the allied nations and the U.S. Also, it would provide the central corps of allied personnel for each participating country to, if desired, begin using Logistics Controlled English for their own publications within and between other countries. Next, of course, it does gain the personnel benefits of contracting out, i.e., a reduction of the number of U.S. personnel required. Lastly, it is possible that allied countries, either directly or through their existing technical documentation cases, such as the Air Force T.O./publications cases, may be willing to share the cost of any required contractor assistance. This further reduces costs to the U.S. government for development and implementation of controlled English if contractor assistance is desired.

The adoption of this second concept, the allied team, is recommended due to the multiple benefits that appear attainable. In any event, as part of this research, a step by step approach that could be used by any development team to develop and implement controlled English in FMS documentation was laid out in detail.

Other Benefits

In addition to the directly intended and demonstrated benefit of improved understanding that will be attained through acceptance of the recommendation to implement controlled English in FMS documentation, there are four other benefits that must be mentioned:

1. *Improved knowledge/expertise of technical writers.* Both NCR and Caterpillar Company noted this as a major benefit, i.e., that to write a simplified, more understandable document, the writers had to have a better understanding of the subject matter. Such increased knowledge by DOD FMS personnel, as the author of the document is often instrumental in formulating the policy or procedure itself, cannot help but lead to improved, more efficient FMS procedures.
2. *Ease of teaching.* One of the areas of difficulty is communicating/teaching of logistics system requirements to allied personnel—the mission of DISAM. The establishment of controlled English could substantially ease this task by first, providing a uniform text technique for all documents the allies would be faced with; second, providing a common base language that could be taught to/required of all students, before arrival at DISAM, which would allow improved communication both with the instructors and with fellow students; and, third, provide a medium for instructors to use in teaching that would increase the effectiveness of their teaching time, and improve overall understanding reached by the students.
3. *Potential automated translation.* The use of computers to do translation has long been a goal as well as a problem to international concerns and scientists. It is a distinct possibility that controlled English may be the solution to that problem. Once Logistics Fundamental English is formulated—one word for one meaning with simple syntax—it will be possible to formulate a word for word correspondence for "controleld German," "controlled Arabic," etc., and, for the first time be able to get a direct "meaningful" translation by an automated process from, for example, Logistics Fundamental English to Logistics Fundamental Japanese, without a loss of meaning.
4. *Application to internal U.S. publications.* A major effort is underway in the DOD, by every service, to simplify and improve the readability of their documentation, procedures, manuals, etc. Whether one is concerned with the Air Force "Fog Anaysis" or the Army grade level of understanding, such efforts are expensive, often duplicative and, to date, without major verifiable results supported by research. It is possible that the end goal of all these efforts may be found in controlled English. Further studies, based on the success or failure of the effort in FMS may be required and, as such, are recommended. If, however, the results of this research effort can be extrapolated to internal U.S. documents, then the answer to what has been a very expensive problem may have been found.

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Warranted Hand Tools

The Air Force Logistics Management Center (AFLMC) recently completed a study on the feasibility of warranted hand tools in Air Force maintenance activities. The study proved that a warranted hand tool will improve tool quality and productivity; and decrease life cycle costs, FOD, injury and equipment damages thus contributing directly to Air Force mission readiness. AF/LEYSP, GSA and AFLMC are finalizing an initiative to implement the use of a warranted hand tool in jet engine shops. The results of this program will determine future applications for other maintenance activities.

Maintenance Publications In Progress

Depot Level Maintenance Production, AFR 66-7, is being revised to include new policy on depot maintenance new starts and the maintenance quality program. (Draft to MAJCOMs for comment in Spring 1981.)

A new regualtion (AFR 66-13) will be issued for depot field teams. (Draft to the MAJCOMs in December 1980.)

Equipment Maintenance Policies, Objectives and Responsibilities, (AFR 66-14), is being revised to include more guidance on Reliability Centered Maintenance (RCM). The Air Transport Association Maintenance Steering Group Document Number 3 (MSG-3), issued in November 1980, is being assessed for inclusion in Air Force RCM requirements. (Draft of AFR 66-14 out for MAJCOM comments in December 1980.)

TO 00-25-4, *Configuration Management System,* is being changed to add a new table for aircraft which use standard commercial work packages.

TO 00-25-107, *Maintenance Assistance,* is being changed to better clarify which tasks are to be funded by AFLC and the operating commands.

Information for Contributors

General. The *Air Force Journal of Logistics* is dedicated to the open examination of all aspects of issues, problems, and ideas of concern to the Air Force logistics community. Constructive criticism of logistics as it exists today is encouraged if it is issue oriented, rationally expressed and indicates the positive action necessary for future improvement. Contributions are welcome from any source inside and outside the Air Force.

Scope. The *AFJL* will consider for publication articles and research results that add to the understanding or improvement of any aspect of Air Force logistics from maintenance, supply, transportation, and logistics plans, to engineering and services, munitions, and contracting and acquisition; from base-level and operational units to depot-level and military and civilian industrial and production logistics; from logistics civilian, enlisted and officer personnel and manpower requirements to training and education; from internal organizational structure, policies and procedures to external relations with other services, government agencies, civilian industry and allies; from daily mission support challenges to the logistics aspects of national security objectives and Air Force strategy, doctrine and tactics.

Special Interest. Articles are especially invited that:

☐ give the results of the application of sound analytical and research techniques to existing Air Force logistics operations;

☐ offer possible alternatives to current operations based on a logical assessment of today's posture and tomorrow's requirements;

☐ demonstrate the interrelation of various parts of Air Force logistics systems internally and with non-USAF systems;

☐ consider basic Air Force logistics functions and issues from an unusual perspective;

☐ focus on logistics and Air Force mission accomplishment;

☐ or, provide insight into the reasons for and impact of recent or future changes in Air Force logistics.

Original Material and Revisions. Submitted articles are received with the understanding that:

1. They have not been published nor are being considered for publication elsewhere. Articles based on research planned for publication *only* as an in-house report or in symposium proceedings are acceptable.

2. Those articles with multiple authors have been approved by all. The *AFJL* will work with the lead author in preparing the manuscript for publication with the understanding that any approved changes are acceptable to all.

3. To the greatest extent possible, necessary revisions in the manuscript will be coordinated with the author.

Length. In general, manuscripts should be between 2000-3500 words. Shorter and longer papers may be published on an exceptional basis. Formal research papers should briefly recognize the most significant research accomplished in the area of investigation and the relation of that research to the work addressed in the paper. A 50-75 word abstract should accompany each manuscript.

Format. Manuscripts should be typed with one inch margins, double-spaced on one side of standard size bond paper. References should be numbered and double-spaced on a separate page(s) at the end of the manuscript. The double number system for identifying references within the article should be used, i.e., (7:15), with the first number identifying the number of the source in the reference list and the second number indicating the specific page number in that source. When possible, potential textual footnote material should be incorporated in the main body of the article. Do not include a separate bibliography.

Figures and Tables. Supporting figures, if any, should be numbered consecutively and prepared on separate pages, one to a page. The text should clearly indicate where each figure is to appear. Tables should be numbered consecutively and be prepared within the appropriate text of the manuscript.

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(General Dwight D. Eisenhower, 1945)

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